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**Secretary for
Agricultural Technical Services
for the period
1 July, 1976 to 30 June, 1977**

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**Report of the Secretary for Agricultural
Technical Services for the period
1 July, 1976 to 30 June, 1977**

**THE HONOURABLE THE MINISTER OF AGRICULTURE,
PRETORIA**

SIR,

I have the honour to submit herewith the Annual Report of the Department.

W.A. VERBEEK
Secretary for Agricultural Technical Services

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I. Introduction

PROGRESS WITH OPTIMUM LAND USE

It is vitally important to South Africa that her agricultural resources should be utilised for the greatest benefit of all. It is the task of the Department of Agricultural Technical Services to ensure that optimum use is made of the resources in the process of constant development. This important matter is discussed in the Introduction to the Report this year.

It is generally realised that the agricultural resources are extremely vulnerable and this problem has long been receiving attention from the authorities. The appointment of a commission of inquiry into drought in 1920 was the first of a series of steps taken in an attempt to ease this problem. At the time of the depression the Department of Agriculture started several soil erosion schemes to provide financial assistance for farmers in controlling soil erosion on the one hand and to create jobs for the unemployed on the other.

After the Second World War, Parliament unanimously passed the Soil Conservation Act in 1946. Under this Act the Department began to take an active part in conserving the country's agricultural resources. With this legislation as the foundation, very good work was done in the field of conservation, especially with regard to the preparation and financing of farm plans.

In the course of time rapidly changing circumstances showed that it was urgently necessary to make a critical reappraisal of the way in which agricultural land was being used in the Republic. The Minister of Agriculture of the time, Mr D.C.H. Uys, therefore appointed a study committee in 1968 under the chairmanship of Prof. F.R. Tomlinson, the former Director of the Transvaal Region, to investigate and report on the matter.

The following are some of the most important findings of the Committee:

- Agricultural land is becoming increasingly scarce and the part it plays as a production factor is increasing. High-potential agricultural land that is not subject to erosion is extremely scarce and probably does not comprise more than one per cent of the total area under agriculture. If land that is susceptible to erosion is included, the total area of high-potential agricultural land is no more than four per cent.
- The scarcer the high-potential land, the more important it is to retain every hectare of it for agricultural production. A policy of

protection in respect of agricultural land, particularly high-potential agricultural land, is therefore very necessary.

- Agriculture holds a very poor competitive position in the land market vis à vis other sectors, which are able to outbid it for any piece of land.
- Where land is used for purposes such as township extension, transport routes and recreation resorts the productive capacity of that land is not subject to any demands, as is the case with agriculture. It is therefore in the national interest for poorer land to be used for such purposes as far as possible.
- Where, notwithstanding the best possible utilisation measures, land and water cannot be utilised and/or protected in the national interest, the areas concerned can be demarcated as conservation areas and withdrawn from active farming.
- The subdivision of farms, either by a natural process such as testation or by the sale of part of a farm, or by an organised process of fragmentation such as when small holdings are created, has already assumed vast proportions.

In 1957 there were already 93 000 small holdings in South Africa, 56 000 of which were situated in the Transvaal. This process of fragmentation was curbed, but it has since followed the 25-morgen pattern, which is spreading tremendously at present. A proper pattern of peri-urban small holdings has been urgently needed for some time.

- The position with regard to ordinary commercial farms is equally disturbing. Almost half the farming units in the country do not offer the families on them a reasonable living. These farms, of which there are a large number, are not all of an uneconomic size, but at least a third of the individual farming units in the country are too small to provide a decent living for a family.

The position as regards uneconomic farming units has become more serious in the extensive and semi-extensive farming areas than in the intensive areas.

Small farming units that are not viable give rise to incorrect farming systems and practices, the inevitable result being deterioration and even devastation of the soil. Consequently the level of production and the income potential are permanently reduced and some of the families who farm the units are faced with social deterioration. The problem

is of such magnitude that it demands serious and urgent attention.

- The Committee also found that there is an urgent need for a land classification system that will help to indicate the productivity of agricultural land, and for legislation to control the subdivision of agricultural land and changes in the purposes for which the land is used.

Since the Committee submitted its report in 1968, these conditions have remained basically unchanged.

PRINCIPLES OF OPTIMUM LAND USE

A very important legacy that the Tomlinson Committee left to agricultural science is the principles of optimum land use. This means using agricultural land in such a way that it meets the needs of the present generation and that for all generations to come it will remain in a productive condition.

Broadly speaking, there are three simple but basic requirements an optimum land use system must meet:

(i) Agricultural production must take place in harmony with the natural environmental factors

Every agricultural region in the world has a given inherent agricultural potential. "Inherent agricultural potential" refers to the agricultural production possibilities that are the product of the combined and individual influences of the natural environmental factors, of which topography, temperature, rainfall, wind, soil and vegetation are the most important. These factors determine how well a particular crop will do in a particular area.

(ii) Agricultural production may not take place at the expense of the agricultural resources

A second requirement which an optimum utilisation system must meet is that agricultural production may not take place at the expense of the agricultural resources. The fact that a particular branch of farming is practised in harmony with the environmental factors is not a guarantee that the inherent productive capacity of a resource is not being overtaxed and thus being destroyed.

(iii) Agricultural production must take place on an economic basis

One of the requirements for an optimum land use system is that it must enable the farmer to make a decent living on his farm. Farm size is therefore of cardinal importance within the framework of the other principles. An undersized farm is not capable of being utilised to the optimum.

These three factors cannot be separated and form the cornerstone of sound farming and consequently lie at the foundation of a sound agricultural economy.

PUTTING OPTIMUM LAND USE INTO PRACTICE

Optimum land use is an ideal which should be consistently pursued. It is a process that will continue as long as technological development continues.

When the principles of optimum land use are carefully analysed, it becomes evident that the pursuit of those principles is a continuous, complicated and highly scientific process. This means that the task requires effective planning and execution. In any case, it goes without saying that knowledge of the natural environmental factors is fundamental to the concept of optimum land use and that any development in the industry will have to be adapted to these factors. In fact, it would be possible to evaluate how optimum land use is being put into practice only if one approaches the matter from an environmental angle rather than from the point of view of the industry.

Therefore the following measures are necessary to make the concept of optimum land use a reality:

- The demarcation of fairly homogeneous areas in respect of agricultural resources.
- The setting up of yield norms in respect of crop and animal production and production techniques.
- The laying down of guidelines for fairly homogeneous areas in respect of adapted branches for farming and the combining of such branches of farming wherever possible.
- The drawing up of programmes to promote the yield norms, the production techniques and the guidelines that have been provided in respect of the branches of farming.
- The evaluation of the progress made in implementation of the concept of optimum land use.
- The continuing exploitation of agricultural potential by means of goal-oriented research through which higher yield norms can be set, production techniques improved and more clarity obtained on adapted branches of farming and the ways in which they can be combined.

These six measures can be regarded as separate steps, but it should be remembered that it is not possible to apply them strictly in the sequence in which they are listed in all parts of the country and under all conditions. With the co-operation of other Departmental bodies, the regional organisations have undertaken the most important task of drawing up plans in which the various measures have been taken into account, and of constantly promoting the concept of optimum land use, due regard being had to priorities.

THE PART PLAYED BY THE GOVERNMENT AND DEPARTMENTAL BODIES IN PUTTING OPTIMUM LAND USE INTO PRACTICE

Cabinet decision

In a memorandum sent to all Government departments in 1975 it was stated that the Cabinet had decided -

- (a) that the preservation of good agricultural land was a matter of national importance;
- (b) that the Department of Agricultural Technical Services should, as a matter of priority, identify good agricultural land; and
- (c) that the Department of Planning and the Environment and all other authorities concerned with planning should try, within the framework of their functions, to retain for agriculture as far as possible any land identified as good agricultural land or potentially good agricultural land.

The Department is receiving increasing co-operation and support from all Government departments and semi-Government institutions in carrying out the Cabinet decision, and wishes to express its thanks for the co-operation it has received so far.

During the year under review the Department, after consultation with the Administrators of the provinces, the Secretary for Planning and the Environment and the Secretary for Transport, and the Directors of Roads, agreed on a liaison procedure in cases where new roads are planned.

The Department presented the results of a study on the agronomic potential of the rapidly developing Eastern Transvaal Highveld to the Secretaries of eight Government departments, the Transvaal Provincial Secretary, the General Manager of the South African Railways and Harbours, the Chairman of ESCOM, and the Director of the South African Agricultural Union. The study showed the production potential of five field crops in seven climatic zones in respect of eight soil classes. Areas with a lower agronomic potential, which it would be preferable to use for purposes other than agriculture, were identified.

THE COMMITTEE OF INQUIRY INTO RURAL REFORM

The Committee, under the chairmanship of Dr S.J. du Plessis, was appointed by the Minister of Agriculture in June 1971. The first part of the report was published in April 1977.

Some of the most important findings of the Committee are the following:

The Committee found that in 1970 there was a total of 49 magisterial districts in the country where 40 per cent to 67 per cent of the families had incomes of R2 000 or less. Thirty-nine of these districts were situated in the Cape, five in the Transvaal and five in the Free State.

The Committee took a net farm income of R3 500 a year to be the minimum on which a White farmer could maintain an acceptable standard of living in the year (1973) in which that part of the inquiry was conducted. By this criterion 40 per cent or more of the farms were not viable or suitable.

When the position with regard to the incidence of uneconomic farming units in certain districts was examined, the Committee could not always find a correlation with the rainfall or drought position. In several cases it would appear that this phenomenon is associated with the so-called submarginal areas where ill-adapted farming systems have sometimes been conducive to excessive subdivision of farms.

The Committee nevertheless found that neither the debt ratio of farmers nor their financial position was unrealistically low or poor.

In the course of its inquiry the Committee became convinced that the problem of uneconomic farming units and its effect on the agricultural industry and the agricultural resources has already assumed such proportions that it must be regarded as one of the most serious problems in agriculture today.

The second part of the Committee's report was published in May 1977. It contains proposals and recommendations for rural reform, the most important of which are:

A consolidated agricultural development act, incorporating the Soil Conservation Act, the Subdivision of Agricultural Land Act and the matters relating to rural reform should be considered.

The Committee recommended that a permanent co-ordinating committee for rural reform, consisting of officers of the Government departments concerned and other experts, should be appointed.

DEPARTMENTAL PROGRAMMES

Although all the divisions and institutes of the Department are involved in the application of the principles of optimum land use, some divisions and institutes have a more direct responsibility in respect of the Republic's resources. These include the Soil and Irrigation Research Institute, the Botanical Research Institute and the Division of Soil Protection.

PROGRESS WITH NATIONAL PROGRAMMES

Soil and Irrigation Research Institute

- The binomial soil classification system for identifying soil forms and soil erosion is being printed and will be published during 1977/78.
- Thirty-five of the 70 1:250 000 land type maps are ready for the printer. Field work on the remaining maps has reached an advanced stage.

- This Institute is also engaged in surveys of peri-urban areas with a view to the judicious expansion of urban complexes.

Botanical Research Institute

The vegetation of almost 70 per cent of Natal has been mapped to a scale of 1:250 000. In the Western Transvaal an area between Rustenburg and the border has been mapped to the same scale.

Division of Soil Protection

Soil Conservation Act (Act 76 of 1969, as amended)

- The planning of 73 per cent of that part of the area of the Republic which is capable of being planned has already been completed.
- About R6 million was paid out in subsidies on soil conservation works in 1976/77.
- Nineteen State works were completed at a cost of R800 000.
- About R50 million was paid out to 6 572 participants in the Stock Reduction Scheme up to 1976/77.
- Total expenditure under the various schemes has amounted to almost R100 million since 1946.

The Subdivision of Agricultural Land Act (Act 70 of 1970, as amended)

This Act has done a great deal to prevent the creation of uneconomic farming units.

Agricultural regions

In that they are the part of the Departmental organisation that has the closest liaison with the approximately 78 000 farmers in the Republic, the regional organisations have a unique part to play in applying optimum land use.

Demarcation of Regions into homogeneous farming areas

On the basis of available knowledge, all the Regions were divided into homogeneous farming areas. As the land type mapping progresses, the Regions will review the boundaries of the homogeneous farming areas wherever necessary.

Mapping of natural resources

With a view to the identification of agricultural resources at the local level, all the Regions are involved, in one way or another and to varying degrees, in mapping the natural resources. These maps form the basis for land use plans. An area of about three million hectares has already been mapped.

Norms

When a map of the resources of a farm or area has been drawn up, the chief task of an agricultural scientist is to express the data objectively in terms of yields and/or carrying capacity. By following this procedure for all

alternative uses of the land and expressing the yields and carrying capacities in terms of net farm income, and taking any limiting factors into account, it is possible to plan for maximum sustained economic production.

The Department has mathematical formulae by which average grain yields can be calculated for the inland plateau for the most important crops. Computer programs are available for calculating the nutritional requirements of livestock, lactation curves, soil loss, and pasture productivity. Yield norms and production practices are also available for wine and table grapes and wheat in the Winter Rainfall Region. All the Regions of the Department are actively engaged in determining norms.

Drawing up guidelines for adapted branches of farming

The regional development plans make provision for adapted branches of farming for each homogeneous farming area.

Through the preparation of land use plans adapted branches of farming, yield norms and production techniques were identified within the three million hectares classified on a farm scale. In the Upper Orange Catchment, area plans were prepared for half the subcatchments, and land use plans for individual farms, where required. In other parts of the Republic the same kind of planning is undertaken in areas selected for development purposes.

Evaluation of the progress made in implementing the principles of optimum land use

The Department requires that the aims of all registered projects be capable of being evaluated and that progress reports be submitted at regular intervals.

A great deal has already been done to classify the agricultural resources of the Republic and much work is still being carried out. The big challenge for the future is to reach far more farmers at the farm level.

The use of colour aerial photography and mechanical soil augers and the training of farmers to classify their own soils in cases where the soil series is already known, are possibilities that should be explored.

The Department and the CSIR are co-operating on a project to determine the usefulness of satellite pictures as a basis for the classification of agricultural resources. If this attempt succeeds, the use of satellite pictures will be systematically encouraged and expanded.

An important task of land use planners is to express data on soil, vegetation and climate in terms of yields or carrying capacity. The first efforts in this connection were successful, but the field to be covered is a very wide one, and a great deal of work will have to be done before all crops, soils, types of vegetation and climatic zones have been covered.

The action outlined above will be of little use unless it results in a change for the better in land use on farms. The Department will therefore step up the programme to make the farming community aware of the principles of, and measures required for, optimum land use.

Realising the agricultural potential through research

The principle the Department applies here is that research projects should have their origin in the steps that have led up to these projects in the content of development programmes.

In the nature of things research projects aimed at optimum land use should be multi-disciplinary. The Department has therefore constituted several working parties to cover the relevant disciplines. An important function of these working parties is systems simulation, which is aimed chiefly at integrating research data from various fields into mathematical models and which can serve as a basis for the design of farming systems. These models are developed in such a way that they will have direct application in determining management and planning practices.

CONCLUSION

The principles underlying land use make the following three functions necessary:

Specific legislation aimed at preserving the natural resources must be applied. The two most important acts here are the Soil Conservation Act and the Subdivision of Agricultural Land Act. In our system of government there is only one body, namely the Department of Agricultural Technical Services, that runs an extension service (professional and technical) partly for this purpose.

The second function relates to the requirement that particular farming activities in a particular area should be in harmony with the environmental factors (soil, veld, climate). This function entails the following:

1. Homogeneous farming areas in the Republic should be outlined.
2. Production and practice standards for crops and animals within these homogeneous farming areas should be formulated (or researched).
3. As a prerequisite for 1 and 2, natural resources such as soil and vegetation should be classified and the effect of climatic factors interpreted.
4. Adapted branches of farming and possible systems for homogeneous areas and individual farms can then be designed.

5. However, since nothing under points 1 to 4 above has really been done to promote rational agricultural development, the approximately 78 000 farmers of the Republic (or the largest possible number of them) should engage in adapted enterprises (and systems) on their farms before the agricultural industry can be said to be operating at the optimum level of efficiency.

Points 1 to 4 require mainly experienced graduates in agricultural science, with the necessary technical backing. The emphasis here falls on experience. The classification of soils requires sound knowledge and skill and is an exacting and time-consuming task. To determine production and practice norms on a scientific basis, relate these norms meaningfully to a system of resource classification and, finally, interpret all these data so that adapted enterprises and systems can be designed, is a task which makes high demands on the agricultural scientist.

In addition any organisation trying to perform the tasks under points 1 to 4 efficiently needs to have a broad spectrum of knowledge, skills and techniques at its disposal - a spectrum ranging from the most basic agricultural research facilities and access to and co-operation with the various related disciplines such as engineering and economics, to co-operation with top farmer collaborators within demarcated areas from whom are obtained norms that have not yet been formulated by research.

It is clear from the foregoing that only an organisation like the Department of Agricultural Technical Services can carry out this task successfully.

The extension service of the Department of Agricultural Technical Services has a very great responsibility as regards realising the ideal of optimum resource utilisation - the best possible basis for rational agricultural development.

It is of the utmost importance to South Africa as a whole that the policy of optimum land use should be applied throughout the country, down to the level of the individual farm. Optimum performance by the agricultural industry will not only ensure that there will always be sufficient food for the rapidly growing population but it will also have a stabilising influence on all sectors of the economy, as well as in the social sphere, where a sound agricultural industry is indispensable, especially in rural communities.

II. Plant Production Improvement

FIELD HUSBANDRY SUMMER CEREALS

MAIZE

Breeding

The highlights of the maize breeding programme at Potchefstroom during the 1976/77 season were the following:

- The development of disease-resistant pure strains was taken one generation further. Because certain diseases, chief of which were northern leaf blight *Helminthosporium turcicum*, maize rust *Puccinia sorghi*, boil smut *Ustilago maydis* and streak, occurred naturally, it was possible to make good selections. Selection for head smut *S. reiliana* after artificial infection was again highly successful.
- The development of plant populations with strong stems which will remain upright for a long period is progressing favourably. It will be possible to make useful material available to private breeders later on.
- When pure strains were evaluated for resistance to the maize stalk borer major differences were found. Highly resistant material was distinguished and used in the breeding programme.
- With a view to the identification of useful inbred strains for private breeding establishments, a series of single crossing trials was undertaken for the first time in co-operation with members of the SA Plant Breeders' Association at three localities in the maize production areas, viz Lichtenburg, Delmas and Greytown. Strains that combine well were identified in the trials and made available to private breeders for inclusion in their breeding programmes. Good breeding material from the Departmental breeding programmes should soon be available to producers in the form of either cultivars or hybrids.
- The breeding programme to develop sweetcorn hybrids for the canning and freezing industry was continued. In co-operation with the industry, promising hybrids were again planted at Delmas, George, in the Gamtoos Valley, at Cape Town, Tzaneen and Cradock, and evaluated for canning and freezing. Several hybrids were

selected by the industry on the basis of yield and quality as replacements for the existing hybrids, which were bred overseas.

High-lysine maize

A total of more than 60 white experimental opaque-2 (high-lysine) hybrids were evaluated at numerous localities. The results obtained again confirm those of the past three years, namely that white experimental opaque-2 hybrids are available that equal or even exceed the yields of the best normal commercial hybrids.

The yellow opaque-2 single cross has equalled the yield of PNR 536, the highest-yielding yellow commercial hybrid. This result is particularly promising for the animal feed industry.

Susceptibility to diseases and a relatively soft kernel are remaining though not insurmountable problems, particularly in white opaque-2 hybrids. Experimental seed sufficient to plant 600 hectares of this hybrid type was produced at the Ukulinga Research Station and the Cedara College of Agriculture in 1976/77 and is now available for further extensive evaluation and feasibility studies on high-lysine maize in South Africa.

Pig feeding trials conducted at the Animal and Dairy Research Institute at Irene with the locally bred experimental hybrid N05101 have shown that the use of opaque-2 maize instead of normal maize in pig diets may save as much as 22% of the fishmeal normally used, a finding which has important economic implications.

The progress made in the breeding of conventional or normal maize has been highly rewarding. Record experimental yields of 12 400 and 11 600 kg per hectare were obtained in Natal at high plant populations, whereas at Delmas yields in excess of 9 000 kg per hectare were obtained at slightly lower plant populations with promising new breeding material.

Included in this material are American inbred lines, converted to the major gene HtN for resistance to leaf blight and otherwise selected for adaptability under local conditions. This and other promising maize breeding material is earmarked for release to commercial breeders in the coming year.

At Cedara, lodging in maize has been reduced by treating the crop with Ethrel. Stem lodging was reduced by 38% and root lodging by 9.5%. Cob height was lowered by 50 cm and brace roots were increased by 45%.

Savings in grain and in machinery and labour costs are considered sufficient to make Ethrel

application a paying proposition in high-yielding maize lands that have a lodging problem.

Cultivar evaluation

The programme for evaluating new cultivars at the Summer Grain Centre showed the following progress:

Evaluation of new maize cultivars

During the past season 25 new cultivars were planted at 22 localities in the maize production area in order to test their adaptability. Promising results were again obtained from these trials.

Evaluation of popular commercial maize cultivars

During the year under review 49 commercially viable cultivars were planted at 33 localities in the maize production area in order to determine their agronomic adaptability. These data are also used for area zoning and for determining the risk index of areas.

Evaluation of grain sorghum cultivars

During the past year 42 cultivars were planted at 24 localities in the grain sorghum production area. These trials included seven new cultivars, two old open-pollinated varieties and 33 recognised commercial hybrids.

Characterisation of grain sorghum cultivars

A characterisation trial was carried out at Potchefstroom with 10 popular grain sorghum cultivars. The effect of the planting date and espacement on the growth and development of plants was studied in this trial and observations were carried out on the following: the development of plants from planting to flowering, kernel development up to physiological maturity, kernel drying rate, tiller development, grain:straw ratio and grain production.

Characterisation of maize cultivars

The effect of the planting date on the behaviour of 25 commercially viable maize cultivars was investigated. The characters which are affected and which are of biological value are the following:

- Growing season from planting to flowering to physiological maturity
- Drying rate
- Kernel growth rate and duration of growth
- Grain : straw ratio
- Grain production
- Yield components - number of cobs, cob size, number of kernels per cob, kernel size, kernel mass and kernel quality.

Soil cultivation

Soil cultivation studies were started in the North-Western Free State on two soil series that are sensitive to wind erosion and mechanical

compaction. Good indications of the harmful effect of compaction on root distribution in the subsoil were obtained from profile investigations and soil strength measurements. The applications of deep tillage with tined implements, traffic control, modified row espacements and chemical weed control relieved the problem effectively and prevented fresh compaction.

Plant feeding

The crop response of maize to nitrogen, phosphorus and potassium fertilising on a variety of soils in the Eastern Transvaal Highveld again showed that nitrogen is the element mainly responsible for yield increases. The response to phosphorus is dubious (depending on the soil phosphate analysis and the pH), and no positive response was obtained with potassium.

On a soil poor in phosphorus the application of phosphorus in the form of a crude, water-soluble phosphate during the past season produced a very favourable response in respect of grain yield. It would also appear that there is little point in preferring one type of phosphorus carrier to another.

Entomology

Maize stalk borer

The results of a trial aimed at controlling the maize stalk borer *Busseola fusca* by chemical means showed that the systemic insecticide carbofuran is very effective against this pest when it is applied in the planting furrow at planting time. It is also promising for use against stalk borers and aphids on grain sorghum if the risk of phytotoxic damage can be eliminated. However, there is a need for effective preparations for use against late infestations on maize because the available preparations produce poor results when administered after flowering.

Research on the determination of economic threshold values in stalk borer control indicates that where 5 per cent oviposition is found on plants 2,5 weeks after emergence a crop loss of 12,5 per cent can be expected. The crop loss : oviposition ratio decreases as the period between emergence and oviposition increases. On the other hand the degree of direct damage to the cobs increases as the period between emergence and oviposition increases. The aim is to provide data that will enable the producer to take a decision, at any stage of growth and at any level of infection, on the economic advantages or drawbacks of treatment, in accordance with the potential of his crop.

Leafhopper streak vectors

Several new species of possible streak vectors were found in the maize areas. One appears to carry a previously unknown maize virus. Bulk breeding methods for the chief vector *Cicadulina mbila* are being developed. A method of infecting maize breeding material with streak artificially in the field has also been developed and this should lead to more rapid progress in the search for resistance to streak in maize.



Nematodes

Nematode infestation is a major factor in the reduction of maize yields. Fumigation of maize soils with DD to suppress nematodes produced an average increase in the yield of 33,5% in trials in the maize triangle; the increase in fact varied from 14% to 63,8%.

Granulated formulations of several nematocides were administered at planting in an attempt to create a practical control method for the maize farmer. Carbofuran appeared to be the most promising and produced crop increases of 28 to 42 per cent. The results also showed that nematode infestation has an adverse effect on the utilisation of several fertilisers. It was also found that maize cultivars differ in respect of their sensitivity to this pest. Top priority is being given to this investigation.

Plant pathology

Leaf spot

The evaluation of 78 maize hybrids and segregating breeding material from the breeding

programme for susceptibility or resistance to several kinds of leaf spot was undertaken at Potchefstroom. A mist blower system was used to create optimum moisture conditions for infection. This is a very promising method of evaluating hybrids and breeding material accurately for resistance to the various kinds of leaf spot.

Anthracnose

The evaluation of 78 maize hybrids for susceptibility or resistance to anthracnose *Colletotrichum graminicola* was successfully carried out and an acceptable technique for evaluation was discovered. A survey on the incidence of the disease was carried out in the chief maize areas. This survey shows that the disease is more liable to occur on light soils.

Boil smut

Progress has been made with the development of a method of infecting maize with boil smut in order to evaluate breeding material and hybrids.

Streak

The observations made in trials showed that insects prefer certain genotypes, so the accurate evaluation of mixed populations of genotypes is not possible. These studies showed that forced feeding is necessary for the evaluation of plants or cultivars.

Progress was made with the segregation of races and identification of viruses concerned in the complex.

Grain sorghum diseases

Very little is known about the diseases of this crop. The identification and study of sorghum diseases were started last season.

Artificial methods of infection are required whenever breeding is undertaken for resistance to disease. This matter is receiving attention.

WINTER CEREALS

WHEAT

At present more research is being done on wheat than on any other type of small grain. The research programme for the summer rainfall area and the irrigation areas includes the evaluation of cultivars and elite breeding strains in various ecological areas, fertilising trials and trials with chemical weed control.

During the year under review 61 wheat cultivar and 33 elite wheat trials were carried out on dry land over the summer rainfall area and under irrigation all over the country. In all 12 cultivar and 4 elite trials were planted on the Springbok Flats, which is a fairly new production area. At the latest release meeting one spring wheat strain was proposed for release in the Eastern Free State and two long-straw strains for release in the winter rainfall area and the Eastern Free State.

In the Free State Region fertilising trials were carried out under irrigation at Sandvet, Vaalharts and Riet River with varying levels of nitrogen and phosphate, and different levels of irrigation. The results again showed that 90 to 130 kg of N and 25 kg of P per ha are sufficient for the existing cultivars.

In the past chemical weedkillers were always applied when a certain number of leaves had appeared on the main stem. Research has revealed that the use of leaf numbers as an indicator of when to apply hormonal weedkillers may cause considerable crop losses. It has also been found that crop losses can be kept to a minimum by using growing point development as the indicator instead of leaf numbers. It has also been established that the wheat plant is the least sensitive to hormonal weedkillers between growing point stages six and nine.

The following aspects of wheat research are receiving attention in the Winter Rainfall Region:

Cultivar trials

The cultivar trials with 22 released cultivars and entries were planted at 22 localities.

Long-straw and short-straw types were planted separately at various seeding densities and were also differently fertilised.

The yields of the semi-dwarf types were generally higher than those of the long-straw types. In the Swartland the average yields from the semi-dwarf and long-straw types were 1460 and 1168 kg per ha respectively. The average yields in the Swartland and Rûens were virtually the same.

As in 1974 and 1975, the best cultivar in all parts of the Swartland was SST3, with an average yield of 1722 kg per ha. After SST3, Sonderend and Inia performed best. These three cultivars were also found to be the best in the Rûens, in the same order. Memnon was the best long-straw cultivar in both the Swartland and the Rûens.

The average yield in the Swartland was lower in 1976 than in 1975, chiefly because of the higher rainfall, which not only delayed sowing early in the season but also reduced the mass per volume at harvest time.

In the drier parts of the Rûens the 1976 yields were higher than those of 1975, but in the high rainfall area of Caledon the yields were lower during 1976, chiefly because of the delay in sowing.

Diseases did not affect the yield much in the Swartland. Stem rust occurred generally, but in a mild form and mainly on the long-straw types. The semi-dwarf types were more subject to *Septoria*, but not in so severe a degree that the yield was affected.

In the Rûens stem rust occurred generally but with the good rains in September and October the yield was not much affected. T4 was hardest hit by rust. In 1976 T4 was the best cultivar in the Rûens, but in 1977 it did not do nearly as well. *Septoria* affected cultivars such as Inia, Sonderend and Elize to some extent. In the South-Western Districts yields were generally poorer in 1976 than in 1975, chiefly because of the high rainfall in October, which caused the wheat to lodge.

It was only in the drier areas such as Uniondale that the average yields were higher in 1976 than in 1975. SST3 was also the best cultivar, here, and Zambesi, Inia, Sonderend and T4 did not do badly.

Seed multiplication

About 500 bags of basic seed of several cultivars were delivered to the Wheat Board.

Evaluation of strains

If stability is to be maintained in the wheat industry, new high-yielding cultivars of good quality have to be supplied to the industry regularly. The elite trials in which the strains in question were evaluated were planted at four localities each in the Swartland and Rûens in 1976 and at three localities in the South-Western Districts and Eastern Cape.

The release of the long-straw strains BT37 and BT38 was recommended on the basis of the data obtained from 1974 to 1976. Both were bred and selected at Bethlehem in a back-crossing

programme using Flameks. They produce good yields of high quality wheat, but their best characteristic is their resistance to rust. Other promising strains are also beginning to emerge.

Rotational cropping and farming systems

Five farming and rotational cropping systems underwent further evaluation at Langgewens in the Swartland. The systems are as follows:

W.W.	Wheat, monoculture
W.F.	Wheat, fallow
W.L.F.	Wheat, lupins, fallow
WgGGg	Wheat, two years of grazing - rotational grazing
WgGGc	Wheat, two years of grazing - continuous grazing

The effective precipitation from May to October was 271,6 mm in 1976, as against 315,3 mm in 1975. The rainy season started in April, as usual. No significant differences in the grain yield or grain straw were found between the treatments, although seasonal differences were evident. Because of powdery mildew no lupin yields were obtained.

In general animal production parameters tended to favour the grazing systems.

(i) Seeding time

At Langgewens and Tygerhoek the long growing season cultivars produced higher yields when planted during the first half of May. On the other hand short growing season cultivars produced higher yields at the same localities when planted after 15 May. At Outeniqua the planting time did not have such a big effect on the yield.

(ii) Seeding density

Higher seeding density can apparently be beneficial with a higher moisture régime.

(iii) Fertilising

Attention was given to adapting soluble plant nutrients to the rainfall situation.

The year 1976 was characterised by heavy precipitations early in the season over virtually the entire Swartland, and plant nutrients were probably leached away. In a nitrogen fertilising trial, which included both short-straw and long-straw cultivars, an average nitrogen level of 45 kg N/ha produced the highest yields, whereas the normal optimum is considered to be 30 kg of N per ha. In the case of some of the very early types the highest yield was obtained at a nitrogen level of 60 kg of N per ha.

In the Rûens, where good rains occurred late, the wheat plants were able to utilise a higher nitrogen level than the recommended 16 to 20 kg of N per ha. At Tygerhoek the highest yields were also obtained with fertilising at a rate of 45 kg of N per ha.

Cultural trials

(i) Manure and straw with wheat

A series of manure and straw trials has been conducted at Langgewens since 1932; in 1976 wheat was sown for the last time and a final report will be submitted after the final soil analyses.

(ii) Fallow cultivation and a wheat production trial

Data show that different cultural methods at Langgewens resulted in considerable differences in grain and straw yields. As in the past considerably higher yields are obtained with a fallow ploughing treatment in July/August followed by a shallow cultivation in September with either a tined implement or a plough.

(iii) Evaluation of cultural practices for optimum wheat yields in rotational cropping systems in the Swartland (Langgewens)

Data so far have shown that mouldboard ploughing followed by a fallow period with sowing variables produces the highest yields, but that the income is higher with the continuous short fallow period wheat system.

Research on weeds

Four trials on the control of wild oats were conducted with three different weedkillers. None of the weedkillers caused yields to rise in comparison with yields from the untreated controls. This unexpected finding may be ascribed to the fact that the rains were late, so that there was no competition for moisture between the crop and the weeds.

In pot trials the sensitivity of the main wild oats species that occur in the Republic, viz *Avena barbata*, *A. ludoviciana*, *A. fatua* and *A. sterilis*, was tested for five different weedkillers. Sensitivity differed considerably from species to species. This underlines the importance of correct species identification before a weedkiller can be recommended.

In an attempt to control aphids economically several sprayings with demeton-S-methyl were applied to wheat in the Free State Region at various times and various growing stages. It was established that aphid counts are essential before spraying is decided on. According to the results obtained over three seasons, spraying is only economically justified when there are over 30 aphids per stem.

Effective spraying procedures were also investigated. An excellent correlation was obtained between the decrease in droplet size and the increase in poison uptake by young plants, but unfortunately the most effective small droplets may be carried out of the target area by crosswinds when aerial spraying is applied. Spraying

procedures therefore have to be adjusted all the time.

OATS

Owing to early or late heavy rains, yields were generally poorer than in 1975. Rust also occurred. The new cultivars Perdeberg, Overberg and Potberg again performed well throughout the region.

Evaluation of new strains and cultivars: Elite trials

Elite trials were again planted at various localities in the Swartland and Rûens. However, there were considerably fewer entries in the trials, 14 as against 28 in 1975.

Good progress was made in respect of rust resistance. Strains such as 074/5, 075/1, 075/3 and 075/4 appear particularly promising. The latter strain also has a very good yield potential. All these strains are therefore being multiplied in 1977 with a view to later release, if required.

Seed multiplication

Ninety bags of basic seed of the cultivar Potberg were supplied to the industry, as well as 210 bags of other cultivars.

BARLEY

The new cultivar Clipper with its good yield potential caused a revival of interest in barley. Despite the poor 1975 crop, more barley was sown in 1976. The good rainfall during 1976 produced a very good barley crop of good quality.

Evaluation of new strains and cultivars: Elite trials

Thirty-two new strains were tested during the past season with a view to discovering new cultivars. The new cultivar Clipper was again the best of the standards, with a yield of 2850 kg per ha.

Two strains which have performed well over the past few years, viz B73/0 and B73/1, both of which have an acceptable brewing quality, are being grown commercially on contract in 1977 with a view to large-scale brewing tests and possible later release.

There was a very severe leaf rust epidemic in 1976, with the result that diseases such as *Helminthosporium* and *Rhynchosporium* played virtually no part.

Seed production

In all 110 bags of Clipper basic seed were supplied to the industry.

Cultural practices

(i) Seeding time

Unlike certain other cultivars, Clipper is relatively "insensitive" to the seeding time. Seeding time also has a minimal effect on the hectolitre mass and the percentage of plump grains of all cultivars.

(ii) Harvesting method

It appears to be better to cut barley at the yellow ripe stage and allow it to dry in windrows than to thresh it upright. Both the yield and the quality of the barley were higher when it was cut first.

(iii) Nitrogen fertilising

Nitrogen fertilising above 15 kg of N per ha reduces the yield, but raises the nitrogen percentage of the barley. The higher the nitrogen fertilising level, the lower the percentage of plump grains.

RYE

Evaluation of strains and cultivars: Elite trial. Only three strains were sown on the Sandveld. These strains were also multiplied for further testing during 1977.

DURUMS

After thorough consideration by all interested bodies, it was decided to set aside the northern part of the Fish River area at Cradock as the durum growing area. After testing the first durum strain, D6647, was provisionally released. About 80 bags of seed were available and further multiplication is already taking place.

A vigorous extension campaign to encourage the cultivation of durums in this area is already under way.

Plant breeding

All small grain breeding undertaken by the Department has now been consolidated into one national programme and all staff engaged in this work now fall under the Small Grain Centre at Bethlehem. The wheat breeding programme provides for 14 liaison projects in which four wheat types, viz dryland spring wheat, irrigated spring wheat, intermediary wheat and winter wheat, are receiving the most attention. A durum and triticale breeding project is being carried out in co-operation with the University of Stellenbosch. Barley and oat breeding are receiving very little attention owing to a shortage of staff.

The breeding programmes provide for the needs of the various wheat areas of South Africa in that the selection of material takes place at several strategic localities. These include Makatini (Northern Natal), Bethlehem, Groblersdal, Sandvet, Cradock (durum), George, Riviersonderend and Malmesbury. The wheat programme also

contributes to about 28 international nurseries, which are maintained by universities and other organisations in various countries.

During the year under review about 600 new crossing combinations were made in all the programmes. 52 542 new selections were made in the segregating populations, 18 668 of which came from the spring wheat programmes and 33 874 from the intermediary and winter programmes. In addition 3 491 new pure breeding strains were tested in yield trials at Bethlehem, Kroonstad, Loskop, Roodeplaat, Tygerhoek and Langgewens, 124 of which were selected for further testing in elite trials at several localities. With regard to the international nurseries, about 6 000 entities were evaluated, 550 of which are being retained for further testing in yield trials.

OILSEEDS AND HIGH PROTEIN SEEDS

GROUNDNUTS

The cultivar Sellie, which was developed by the Department, again performed very well in cultivar trials in all the chief groundnut production areas. The high percentage of select kernels (up to

95%) was characteristic of this cultivar. The planting of Sellie boosted yields by up to 30 per cent. There is a very high demand among producers for seed of this new cultivar and a seed production scheme has already been launched.

The major variation in the genetic quality of groundnut seed available for planting was again confirmed in a seed evaluation trial planted at Vaalharts. Kernel yields varied from 6 834 kg per ha (Sellie) to 3 615 kg per ha for a sample of commercial Natal Common seed.

A research project on the evaluation of a leaf spot control programme was conducted at Vaalharts, Potchefstroom and Dundee. The importance of utilising a longer growing period, made possible by the effective control of leaf diseases, was underlined by the trial carried out at Potchefstroom. Where no leaf spot control was applied, the plots in question had to be harvested at 140 days and the kernel yield was 1 900 kg per ha, whereas with effective leaf spot control few symptoms of disease were evident at 168 days and a kernel yield of 3 500 kg per ha was obtained. In a similar trial carried out at the Vaalharts Research Station the exceptionally high kernel yield of 7 700 kg of kernels per ha was obtained. What was particularly encouraging was the fact that good

Lupins are sprayed against mealybug at the Elsenburg College of Agriculture



control of leaf blotch *Phoma arachidicola* was obtained.

A groundnut growth study project was continued at Potchefstroom. Very high yields were obtained notwithstanding obvious cold damage at an early stage of growth. It was striking that the dry matter build-up and general development were very little affected by these low temperatures. A study of the reproduction efficiency of the groundnut plant revealed that only flowers that appear within 14 to 20 days after the commencement of the flowering period make a notable contribution to the kernel yield.

SUNFLOWERS

The exceptional increase in sunflower production obtained over the past season (an increase in the total yield from 254 694 tons for the 1975/76 season to an estimated 449 000 tons for 1976/77) shows the important part this crop plays in agriculture in South Africa. The performance of the available hybrids contributed a great deal to the success of sunflower production. These hybrids performed very well in cultivar trials conducted in all the chief production areas. The shortage of hybrid seed remains a problem and is delaying the replacement of the traditional open-pollinated cultivars.

The research programme on sunflower feeding and fertilising was continued at the Dundee Research Station. In a fertilising trial on a doveton soil type yields were increased from 500 to 2 500 kg per ha after a dressing of N and P. Increases in the yield of up to 60% were obtained after borax dressings. Good progress was made with establishing the critical boron levels in sunflower leaves. This information will be applied in the diagnosis of boron deficiencies.

DRY BEANS

The national programme of dry bean cultivar trials was launched in the Highveld Region in January 1977.

During the past season 16 trials were planted throughout all the regions except the Winter Rainfall Region. These trials were undertaken in co-operation with departmental research stations, agricultural co-operatives and farmers. In the Highveld Region trials were launched at Potchefstroom, Bethlehem and Delmas.

The new small white cultivar NEP2 produced good yields in all areas - at least 120% of the standard. A few departmental breeding strains produced about the same increases in yield. Large white kidney beans, coffee beans and speckled sugar beans of the Bonus variety showed that they have the potential to produce high yields, but only in certain areas.

During the past growing season an investigation revealed that seed-borne diseases have an adverse effect on the yield in all the production areas. The need for disease-free seed cannot be over-emphasised.

SOYA-BEANS

During the past season a total of 95 soya-bean breeding strains were planted at the departmental quarantine station at Buffelspoort. This material was obtained from the Delta Branch Soya-Bean Breeding Centre in the USA after the visit of Dr E.E. Hartwig, the chief soya-bean breeder at that Centre. The planting performed very well and the material will be evaluated in yield trials during the coming season.

POTATOES

Breeding and selection

Following the experimental results of the past three seasons the imported cultivar Baku was made available to seed potato growers for multiplication. This cultivar produces very high yields, is fairly resistant to several important diseases and is an excellent industrial potato. Its quality as a table potato is also satisfactory.

Several promising breeding strains from the departmental breeding programme are undergoing final evaluation on a practical basis in various production areas at present, with a view to their release. This programme is a final stage of the national cultivar and breeding strain evaluation trial, which is at present being conducted in 10 of the chief potato production areas of South Africa.

Diseases

Late blight

The late blight forecasting services on the Highveld and in Natal were accurate again last season and were very useful to potato producers. The large number of farmers who already make use of the service is an indication of the value and reliability of the forecasting service, which is brought to farmers by means of the radio and the press.

Rhizoctonia

Trials with various non-mercuric fungicides showed that the preparation benodanil could be a suitable replacement for the mercuric preparations. This promising fungicide will probably be registered next year.

Gangrene

The dangerous disease gangrene, which is caused by the fungus *Phoma exigua* var. *foveata* develops during cold storage and can be very successfully controlled with the aid of TBZ (thiabendazole). It has also been found that the correct temperature and moisture conditions during storage are very important factors in restricting the disease. Temperatures should not drop below 3,5°C, and the formation of free moisture on tubers should be prevented. It is also important to keep mechanical damage during harvesting and handling to a minimum.

Fusarium

Trials showed that *Fusarium* dry rot can be very successfully controlled on seed and table potatoes with the aid of TBZ. The preparation has no adverse effect on the potatoes themselves and is not harmful to man or animals. It is predicted that this preparation will be used for table potatoes on a large scale in future, especially in the form of an ultra-low volume mist spray, provided the application for registration is successful.

Virus diseases

The facilities being created for the virology section for potatoes at Roodeplaat are rapidly nearing completion.

During the year under review 665 potato samples, derived from the Sabie/Lydenburg Foundation Seed Potato Scheme, the Departmental breeding programme, the overseas cultivars evaluation programme and the AA seed potato production area, were indexed on several indicators. The Sabie/Lydenburg Foundation Seed Potato Scheme is still maintaining a virus-free status in respect of the chief potato viruses. With the exception of PVX, PVY, PVY^N and PVS, no viruses were traced in samples from any of these sources.

With a view to virus purification for the foundation seed potato unit, thermotherapy was applied and meristem cultures made from the following eight cultivars and selections:

Local cultivars	:	Elsa for PVX
	:	890/20 for PVS
Local breeding strains	:	H11, 18 and 19 for PVX
Imported cultivars	:	Baku, Astrid and Draga for PVX

Three mild strains of the virus PVX were collected and are being cultured at present with a view to determining to what extent the presence of these mild strains of PVX in potatoes can suppress damage by other diseases.

Insect pests

Aphids

Moericke yellow traps were established at eight localities in the Highveld and a survey of winged *Myzus persicae* (green peach aphids) was carried out. Surveys took place from August 1976 to February 1977 and were carried out on a weekly basis. This research was the foundation for a projected forecasting service for Highveld seed producers, to warn them against the occurrence of the green peach aphid.

At this stage it appears that every farmer will have to lay his own traps, since the migration pattern of *M. persicae* differs at various localities in the Highveld.

The departmental forecasting service on population numbers of virus vectors in the Winter Rainfall Region was successfully continued, and

surveys with a view to extending a forecasting service to the seed potato production areas of the Northern Cape and the Western Free State were undertaken during the year under review.

The efficacy of soil-systemic preparations, applied at planting time, in controlling aphids in potatoes is being evaluated in the course of experimental work.

Insects that damage tubers

Surveys on the Highveld showed up to 90 per cent crop damage by black maize beetles and cutworms. This damage meant that up to 20 per cent of the total crop was classified as undergrade potatoes.

A third pest insect which has not yet been identified but is thought to be a member of the snout beetle family is doing considerable damage to potatoes in the Eastern Free State. Research on suitable preparations and practices for controlling this insect is being undertaken.

Irrigation

In the course of a trial at Cedara the effect of various periods of moisture tension on various growing stages was investigated in several potato cultivars. It was found, *inter alia*, that optimum yields can be obtained with as little as 40 mm of water. Yields of up to 55 tons/ha were obtained.

Fertilising

A fertilising trial at Cedara showed that, contrary to the general assumption, high levels of nitrogen fertilising at planting did not retard tuber initiation, or have any significant effect on the number of tubers in BP 1-potatoes.

Experimental work on potassium fertilising shows that this nutrient is not as important as is generally assumed.

COTTON

The increase in production from about 90 000 bales of lint in 1975/76 to 163 000 bales in 1976/77 may be ascribed to larger plantings and more favourable weather conditions. According to the Government Cotton Grader the quality of the cotton was again satisfactory this year.

During the past season there was a considerable shift in the relative contributions of the various cultivars to the total production. This is due especially to the fact that Delta Pine 826 has largely been replaced by Acala 1517-70 in the Marble Hall and Groblersdal areas and in the Northern Transvaal.

Breeding and cultivars

During the past season two selections from the Departmental breeding programme were tested in large-scale experimental plantings in the various cotton areas of the Transvaal. The one selection, derived from an Albar x North Carolina Margin crossing, did so well in respect of both yield and lint quality that its release is being considered.

In the western irrigation areas one breeding strain from Acala SJ-1 is being evaluated in large-scale trial plantings for yield and lint properties. Owing to its tolerance of *Verticillium* wilt, this breeding strain is very promising, especially in the Lower Orange area. This strain is also producing very good yields at Vaalharts.

Good progress is being made in the Departmental breeding programme with the development of okra-leaved strains, and inbreeding for nematode and American bollworm tolerance is also progressing favourably.

In the national cotton cultivar trials cultivars are being calibrated for susceptibility to boll rot *Xanthomonas malvacearum* and major differences between cultivars have been found in respect of this disease, which cause severe damage in certain seasons.

Fertilising

Various N, P and K levels have been applied on the same plots of a shorrocks series at the Loskop Research Station since 1971 and cotton was used as the trial crop during the past four summer seasons. In this soil exhaustion study the only treatment that has produced significant differences in the yields so far has been nitrogen fertilising.

Chemical defoliation

Defoliation trials carried out on the Loskop Scheme show that low night temperatures have a very important effect on the action of chemical defoliant. Most cases of poor defoliation can be traced back to inadequate watering and/or low night temperatures after the chemical defoliant was applied.

CHICORY

Relatively favourable prices for chicory root stimulated interest in the expansion of chicory plantings, but unfavourable rainfall during planting meant that the total area planted was smaller than last season. Owing to the application of more efficient cultural practices, especially better espacement and fertilising, the total yield is expected to be the same as last season. Production is expected to exceed the local demand by about 5 000 tons of dried chicory root.

The research programme on the chemical control of weeds in chicory has progressed so far that four promising weedkillers are being evaluated on production scale in co-operation with the Chicory Study Group.

A fertilising trial carried out on co-operative basis on a farm in the production area showed a very good response to both phosphate and potassium fertilising, notwithstanding the dry season experienced. On a sandy soil with a low phosphorous level a dressing of 166 kg of phosphorus per ha produced an increase in the yield of 4 000 kg of root, and a dressing of 150 kg of potassium per ha an increase of 2 000 kg.

In addition to the cultivar evaluation programme, attention is being given to a programme in which the local production of chicory seed is being investigated. The first progeny tests on locally selected seed appear very promising.

A research programme to evaluate chicory cultivars, especially in respect of the growing period and fibre content, was launched and has already shown concrete results. The cultivar Fredonia produces higher yields than the standard cultivar, Pont de Pierre, if the growing period is extended, but the later harvesting stage is accompanied by too high a fibre content for a product of acceptable quality.

TOBACCO

The Institute's research programmes are directed chiefly towards the improvement of tobacco production methods. The aim of research on feeding, the control of insects and diseases, planting methods, harvesting methods and curing, cultural practices and weed control was to improve production practices for this crop. Progress was made with the breeding of cultivars with multiple resistance to the chief tobacco diseases and pests, and solutions were found to certain technological problems.

Breeding and selection

Flue-cured tobacco

Because all the flue-cured tobacco cultivars grown up to about a decade ago are susceptible to various races of black shank and many tobacco lands are already infected with the fungus *Phytophthora nicotianae* var. *nicotianae*, the breeding of new resistant cultivars was continued. It has already been established that resistance to race 1 of the fungus is polygenetically inherited and that resistance to race 2 is determined by a single dominant gene. This knowledge was utilised in the breeding of TL33 and 38, which are being successfully grown on a large scale at present and are resistant to tobacco mosaic virus (TMV) and powdery mildew *Erysiphe cichoracearum* as well. Other high yielding, resistant strains are being tested at present with a view to releasing them.

Black root rot *Thylaviopsis basicola* already occurs in many tobacco soils and causes considerable crop losses. Resistance from *Nicotiana debneyi* is found in Burley 64 and has been transmitted to a number of flue-cured strains in crossings with flue-cured tobacco.

The increasing threat to tobacco by potato virus Y (PVY) has necessitated breeding for resistance. The transmission of resistance has been effected from at least one recognised source.

Most tobacco lands have to be fumigated against rootknot nematode. Resistance to this pest could therefore make a direct contribution to the reduction of production costs. Strains that already have many of the characteristics of flue-cured tobacco remained relatively free of attacks by the pest, even on soils that are heavily infested with rootknot nematode.

A mechanical trench digger is used for the installation of drainage pipes on crop soils



Burley tobacco

Although the various black shank races are not found in the soils of the chief Burley production areas of South Africa at present, considerable progress has already been made with breeding for resistance. The cultivars CB31 and CB34, which were recently released, are resistant to race 2 of the fungus, and to powdery mildew and TMV. The latest strains are resistant to race 1 as well. Resistance to PVY has also been transmitted to Burley strains.

Air-cured tobacco

Resistance to disease is as necessary in light and dark air-cured tobacco as in the flue-cured type. The success achieved in this regard is evident from the fact that the breeding strain CL8, which is resistant to TMV, powdery mildew and black shank strains 1 and 2, is already being grown on an experimental scale. The *N. debneyi* type of resistance to black root rot has also been successfully transmitted to CL8.

Turkish tobacco

Turkish tobacco selections that are resistant to powdery mildew and TMV are being tested in various areas of the Western Cape. A need for resistant strains arose when the industry expanded to areas where tobacco is severely affected by powdery mildew. Strains with a degree of resistance to black shank have already been obtained and will be subjected to further testing in the cultivation area.

Planting methods

Flue-cured tobacco

Tobacco grown by conventional methods, planted in 100 cm rows with the plants 40 to 50 cm apart in the row, produced the highest yield - 400 000 leaves/ha. Low profile tobacco, where the rows and the plants in the rows are planted closer together, produced the highest yield of high quality tobacco (640 000 leaves/ha). This was obtained with 80 000 plants/ha, topped to eight harvestable leaves per plant. The most efficient way of achieving this stand is to plant two rows instead of single rows on the ridges.

On ridges drawn 100 cm apart the double rows were planted 25 cm apart, with the plants in the rows 25 cm apart as well. In these dense stands weed and sucker control and the topping of the plants were carried out by chemical means as soon as the desired number of harvestable leaves had been produced. This procedure reduces the growing period of the crop, makes once-over harvesting possible and simplifies sorting of the cured leaves. It also increases the yield and the producer's income per ha.

Light air-cured tobacco

There is a need for production practices that will improve both the yield and the quality of this class of tobacco. Good leaf development, production and tobacco quality were obtained with low profile cultivation in which double rows were planted on the same ridge and the plants spaced 25 cm apart in the rows.

Dark air-cured tobacco

In the case of dark air-cured tobacco wide espacement and deep topping of the plants are

customary in order to produce heavy, dark tobacco. This limits the number of leaves per ha and results in proportionally lower yields. In low profile trials in which the plant population was increased and the leaf numbers per plant reduced, large dark leaves were produced, which boosted the yield considerably. Leaf numbers per ha were increased to 560 000.

Burley tobacco

Burley tobacco is harvested by the whole-plant method as soon as the majority of the leaves are ready for harvesting. It has been found that this method produces a lower yield than leaf harvesting, mainly because of the reduction in the dry matter content of the lugs. Low profile methods in which the rows and plants in the rows are planted closer together and deep-topped have produced a considerable improvement in the yield, income per ha and quality.

Turkish tobacco

The average production per ha of Turkish tobacco remains relatively low, although the demand for tobacco of this class is high. It has been found that closer plant espacement in the rows and the topping of plants produced a higher yield and income that were obtained from untopped plants. Furthermore, with 50 cm between double rows planted 25 cm apart the yields were considerably higher than with single row planted 75 cm apart. The highest production and income were obtained with a 50/25 x 10 cm espacement and a topping depth of 14 leaves per plant.

Harvesting methods

Harvesting methods for flue-cured tobacco

It is often necessary to deviate from the conventional harvesting procedure for flue-cured tobacco because of weather conditions or in order to utilise the available drying facilities to the fullest extent. It has been found that dense stands of low-profile tobacco topped to eight leaves per plant can be subjected to once-over harvesting without any loss of yield or quality.

With conventional flue-cured tobacco the harvesting of two, four or eight leaves at a time made little difference to the yield, price or income, or the nicotine or sugar concentration. However, with once-over and whole-plant harvesting the plants fetched lower prices and yielded a lower income than plants harvested by other methods. A comparison of harvesting combinations revealed that the eight-leaf treatment and the combination of four two-leaf treatments followed by two four-leaf pickings produced the highest income.

Harvesting methods for Turkish tobacco

Although whole-plant harvesting of Turkish tobacco requires less labour than other methods, it also results in the lowest production. The picking of 12 to 16 leaves per plant, followed by whole-plant harvesting of the remainder of the

plant produced the same high yield as leaf harvesting alone. There was no difference between cultivars in this respect.

Cultural practices

Induced ripening

It is important that the tobacco farmer should utilise his expensive bulk curers to the full. Here it is very useful if the rate of ripening can be accelerated. It has been found that ETHREL, which releases ethylene, only acts on mature ripening leaves under conditions that are beneficial to natural ripening. In conventional flue-cured tobacco bearing 16 or more leaves per plant only the ripening leaves are yellowed. Low-profile plants with eight leaves per plant show fairly even yellowing of all the leaves within 72 hours of spraying. The result depends on hot, favourable weather conditions.

Sucker control

Chemical sucker control is becoming increasingly important as labour becomes scarcer and more expensive and interest in mechanised harvesting, especially of flue-cured tobacco, increases. In addition to the recognised, registered sucker preparations such as Off-Shoot-T, Antak and Fairtac, two others, viz FST7 and Pay-off, produced good results. Systemic preparations such as naphthalene acetic acid and indolebutyric acid were considerably less effective than MH30.

Weed control

Interest in chemical weed control is increasing among tobacco producers. Stomp, CGA 24705, Ronstar and Destin were included in trials at Kroondal in addition to the registered weedkillers Balan, Planavin, Paarlán and Tillam. Good control of annual grasses was obtained with the registered weedkillers and with Stomp, Ronstar, CGA 24705 and divided applications of Destin. The preparation CGA 24705 was the most effective in controlling nutgrass.

Irrigation

Because tobacco very easily and frequently becomes waterlogged when there is heavy rain on soils of the Arcadia series, many producers are planting on ridges and increasing use is being made of sprinkler irrigation. It has been found that this method makes it possible to control the amount of water applied more accurately than flood irrigation and that it is essential in early spring when the soil has to be prepared for fumigation, ridging and planting. An effective irrigation programme that can be applied in various cultivation areas is being drawn up.

Mechanised harvesting and planting

Tobacco chopper designed and built

The curing and handling of tobacco in chopped blocks about 80 mm square opens up

certain possibilities in the direction of complete mechanisation of tobacco culture. A tobacco chopper was designed and built by the workshop of the Division of Agricultural Engineering. Studies on the curing and handling of chopped tobacco will be carried out during the coming season.

Development of a whole-plant harvesting technique for low-profile tobacco

A simple protomodel intended for whole-plant harvesting of low-profile tobacco was designed and built. A single-shaft trailer with a low bottom is coupled to a tractor-mounted cutter. A pick-up conveyor belt, driven by the wheels of the trailer, is mounted on the trailer and follows directly behind the cutter bar to pick up the cut plants and load them onto the trailer. Further improvements are planned for next season.

Evaluation of tobacco planters

In order to investigate the adaptability of the present tobacco planters and the operating problems experienced under South African conditions, trial plantings were carried out with all three locally available planters. With slight adjustments to the mounting of the planters it was possible to improve the performance in heavy clayey soils considerably; soils of this type cause the biggest problems. The intention is to improve the water supply, plant spacing and compaction still further.

Curing

Wet bulb temperature control in the curing of flue-cured tobacco

The humidistats with which commercial curers are equipped cannot always control the relative humidity of the air in the curer effectively. Trials with both small experimental and commercial curers showed that humidity can be more effectively controlled by means of wet bulb temperature control. Where a humidistat is used, it should be periodically calibrated against a wet bulb thermometer and psychrometric tables.

The curing of Burley tobacco in a bulk curer

High quality Burley tobacco which has been cured in an air-curing barn has a characteristic even brown colour. To obtain tobacco of the same quality in a far shorter period in a bulk curer requires a treatment which involves raising the temperature to 60 °C at a rate of 2 °C per hour. A high percentage relative humidity (90%) has to be maintained in the curer at the same time to prevent the tobacco from drying out.

Humidity control during the colouring stage of flue-cured tobacco

In order to stimulate the even and rapid ripening of flue-cured tobacco it is necessary to allow the leaves to wilt to a certain extent in the curer. Tobacco ripened at a relative humidity of

90% took 74 hours to colour, as against 52 hours at 80% and 38 hours at 70%. Relative humidity percentages of under 70% during the colouring stage are not recommended.

Containerisation of tobacco in curers

The shortcomings of the conventional loading frames for tobacco in bulk curers are well known. During the past season the Protea basket was investigated as a replacement for loading frames. There were still problems with air channelling, especially between the walls of the curer and the basket and between the baskets on the horizontal level.

Packing low-profile tobacco

Preliminary results show that low-profile tobacco can be successfully packed and cured in loading frames, stalk and all, if the necessary precautions are taken to ensure that the tobacco plants are evenly distributed, so that air channelling and the falling out of plants from the frames can be kept to the minimum. This method has certain drawbacks, but is to be recommended from the point of view of mechanisation and distribution of labour.

Ripening and fermentation

Ripening and fermentation of green flue-cured tobacco

If the ripening of green tobacco is continued in a curer or the tobacco is fermented in a bale the quality can be improved by over 100%. High quality green tobacco responds better to this treatment than poorer quality tobacco. In both treatments the improvement in quality is accompanied by a loss of the green colour, slight darkening of the tobacco, a decrease in the sugar content and an increase in the filling power. The percentages of total N, protein N and nicotine do not change significantly. The percentage of α -amino-N is lower in the bale-fermented samples, but tobacco subjected to further ripening in the curer does not show this decline. The bale-fermented tobacco has a fermented aroma, whereas tobacco ripened in the curer does not have this aroma. Differences in the oxidation/reduction potential of the two systems may be responsible.

Reconstituted tobacco

When fresh, ripe (yellow) tobacco leaves are processed into reconstituted tobacco the browning or darkening of the product can be prevented with the aid of sodium metabisulphite, which also prevents the loss of sugar during fermentation. The sodium metabisulphite acts as an anti-oxidant, preservative and bleach. Similar trials with ascorbic acid show that the latter is not as effective in preventing browning.

Formation of red pigments in flue-cured tobacco

Red pigments may develop in tobacco as a result of various conditions. Analytical results show that the pigments are also related to the formation of a complex between oxidation products of the polyphenols and the protein in the tobacco. The increase in intensity of the red pigments is related to a corresponding drop in the free polyphenol content.

Respiration studies

During the early stage of development of the leaf (100 mm length) the respiration rate is high; it declines gradually during the growing period. The respiration rate of low-profile tobacco declines more rapidly after topping than that of conventional profile tobacco. Within 6 hours of the harvesting of tobacco leaves the respiration rate increases rapidly and reaches a maximum after about 18 hours, after which it decreases to a low level associated with the death of the tissues. This respiratory climacterium is more prominent in low-profile tobacco than in conventional profile tobacco.

Diseases and pests

Black shank *Phytophthora nicotianae* var. *nicotianae*

When preheated methyl bromide gas is applied to tobacco seed beds control of the disease is apparently better than when the gas is applied in the cold form.

Previcur applied on the land provided 50 per cent control of the disease on badly infected soil, with a highly susceptible tobacco cultivar. Further work on methods of application is planned.

Black root rot *Thielaviopsis basicola*

Because various races of the fungus may occur, existing sources of resistance can be circumvented. For this reason various species, cultivars and breeding strains are being evaluated for susceptibility to various isolates of the fungus. It has been found that *Nicotiana rustica* and *N. repanda* and the tobacco cultivars Pobeda, D7 and White Burley have a fair degree of resistance to the disease.

Brown spot *Alternaria alternata*

Various infection techniques were investigated. Successful infection was obtained by infecting plants with infected leaf material which had been ground fine. This method can now be used for the evaluation of tobacco species and cultivars as sources of resistance.

Angular leaf spot and wildfire

The pathogenic bacteria of these two diseases very soon lose their virulence in culture. By passing isolates repeatedly through a susceptible host it was possible to make some isolates recover their virulence.

Kromnek

Kromnek in tobacco is transmitted by *Thrips tabaci*. Various insecticides have been used to establish whether they can kill the insect rapidly before it is able to transmit the virus to healthy tobacco. Slight success was achieved with acephate.

Potato virus Y

Various insecticides were tested on Burley tobacco to establish whether they could kill the vector before it transmitted the virus to healthy plants. No successful control measures have been discovered. A number of Burley and flue-cured cultivars and breeding strains were therefore artificially infected with the virus to discover whether there are sources of resistance among the local and overseas cultivars. Three Burley and four flue-cured breeding strains with moderate resistance to the virus were found.

Leaf curl

It has been established over the past seasons that one of the components of the leaf curl virus complex passes through the egg of the white fly vector. This component, which causes vein clearing, is associated with the primary stage of the disease. It has also been established that the vein clearing component can be transmitted by inoculation.

Cigarette beetle

The uses of tetrachlorvinphos, 50% wettable powder (Gardona), which was registered in 1975 for the spraying of walls and floors of tobacco sheds, were extended to include the spraying of tobacco bales and crates. The latter treatment has no adverse effect on the final product.

Two ultra-low volume formulations, which have dichlorvos and pyrethrin as their active ingredients, were registered as preparations for treating large areas. The 5% ulv pyrethrin formulation provides effective control of the cigarette beetle at about half the cost of the standard 0.5% formulation, and the cost of the 85% ulv dichlorvos formulation is about one tenth of that of the 0.5% pyrethrin formulation. Dichlorvos can, however, only be used for covered tobacco (e.g. bales, crates, etc.).

Aluminium phosphide was registered for use on tobacco bales, crates, cartons and stacks. Registration was also requested for magnesium phosphide which, according to experimental data, could reduce the cost of phosphine fumigation considerably.

It has been found that vacuum fumigation with ethylene oxide (ETOX) at the prescribed dose does not provide effective control of the cigarette beetle. However, if the tobacco industry will accept sterile cigarette beetles as dead for all practical purposes, it appears that gamma irradiation could replace vacuum fumigation in future.

Tobacco moth

A tobacco moth colony has recently been established and preliminary trials indicate that a synthetic pyrethrin formulation NRDC-143 could possibly provide residual control.

Nematodes

A bed trial with hot methyl bromide gas showed that a dose of 500 g/10 m², hot or cold, controls rootknot nematode effectively in sandy soil, red loam and turf.

Commodity extension

Farmers' days and meetings of study groups were held on 17 occasions in the various tobacco areas of the Republic. The meetings were attended by 378 tobacco producers. Staff of the Institute visited 659 farms in connection with cultivation problems, and 670 producers and persons connected with the tobacco industry visited the Institute and its field stations.

Close contact was maintained with the extension service of the various tobacco co-operatives by means of group discussions between officers of the Institute and extension officers of the co-operatives.

HORTICULTURE

POMES AND DRUPES

Winter Rainfall Area

During the past season the most important branches of the deciduous fruit industry, namely apple and table grape production, were hit hard by natural disasters. In spring the fruit set was very poor on account of the continuous cold and rainy weather and afterwards the fruit swelled very slowly and unevenly. Later diseases such as apple scab and downy mildew in table grapes caused severe losses. Widespread hailstorms towards the end of November did considerable damage to the fruit in apple orchards. The bad weather continued throughout the summer and contributed to the botrytis problem in vineyards and bruising in apples. It was estimated that these factors were responsible for the production of marketable table grapes dropping by almost 50% and that of apples by 40%. Even the excellent prices obtained overseas this year could not compensate for these losses.

The first super grade certified rootstocks were made available to nurserymen with the necessary qualifications by the South African Plant Improvement Organisation. Progress with the multiplication of selected and purified scions and rootstocks of deciduous fruit and table grape cultivars has been so good that it is anticipated that it will be possible to supply the industry with considerable quantities of improved plant material from 1980 onwards.

New cultivars

The breeding and evaluation programme at the Fruit and Fruit Technology Research Institute has shown marked progress and it has been possible to release two new drupe cultivars under the names of Reubennel and Palsteyn.

Reubennel is a new midseason plum cultivar specially bred for export. This cultivar regularly produces high yields of fruit of outstanding quality and keeping quality, is highly resistant to disease, self-compatible and well-adapted to local conditions. Reubennel is expected to replace other midseason cultivars soon.

Palsteyn is a new apricot cultivar. It has excellent fruit properties, such as exceptional size, firmness and good keeping quality. This cultivar is therefore eminently suitable for export and with the lye peeling process it produces a very attractive canning product of a high quality. The young trees showed considerable resistance to the numerous bacterial and fungus diseases to which apricot trees are subject.

PEARS

Fruit set in Packham's Triumph pears

The results obtained this year with pruning treatments indicate that the poor fruit set of Packham's Triumph can be ascribed to excessively heavy flowering and strong shoot growth in spring, which exhaust the nutrient reserves of the trees to such an extent that fruit set is seriously impaired. The crop of young pear trees in pots was trebled when the number of flowers was reduced by half. In orchard trials the crop was increased by 30 to 50% by the severe thinning of fruit spurs and the removal of luxuriant growth in order to control flowering and eliminate competition. It would appear from these trials that by judicious pruning the producer can bring his pear trees into bearing from the fourth year, instead of waiting eight years or more for the trees to start producing a good crop, as is the case at present.

APPLES

Training methods for apples

A decline in fruit size and the concentration of the crop at the top of the tree because of overshadowing has become a general problem in palmette-shaped hedges over the past years. In a trial with Golden Delicious and Granny Smith palmette-shaped hedges in full bearing, spaced at 3,6 m x 1,8 m and 4,5 m x 2,7 m respectively, overshadowing was eliminated by changing to a pyramid-shaped hedge and thinning bearing wood judiciously. This change was accomplished by severe winter pruning followed by summer pruning in December of the following summer in order to restrict growth, and then winter pruning only in the following years. The treatment was compared with a conventional programme which did not include such drastic pruning. The results showed that fruit size can be considerably improved by severe winter



pruning, but this practice reduces the size of the crop to such an extent that it does not pay as long as small fruit are fetching a relatively good price. Major changes in the shape of the palmette are therefore not recommended and any modifications should preferably be spread over a few seasons. Summer pruning in December cannot be recommended because it reduces the size of the fruit.

Progress with research on bitter pit

Bitter pit is a serious physiological malady of apples which causes an unsightly rash of dark depressions on the surface of the fruit. The condition sometimes develops on the tree, but usually occurs long after the fruit has been picked, which is particularly undesirable in the case of export fruit which is packed immediately after picking. Consignments of apples that arrive

overseas with bitter pit could be damaging to the good name of our product and cause serious losses.

It has already been shown that the development of bitter pit is closely related to a low calcium status in the fruit and research is aimed chiefly at increasing the calcium content. Considerable success has already been achieved by spraying the fruit with calcium nitrate in summer and improving the calcium status and pH of the soil by means of lime dressings over a long period. However, over-fertilising with potash can be very harmful because it not only suppresses calcium uptake but also accelerates calcium leaching from the soil.

An important cause of the low calcium status in the fruit which has recently been identified is competition for the available tree calcium between luxuriantly growing shoots and the developing fruit during the growing season. It is therefore

recommended that practices that encourage excessively luxuriant shoot growth, such as unnecessary nitrogen fertilising and irrigation, over-severe winter pruning and excessive thinning of the fruit, should be avoided. On the other hand, judicious summer pruning to restrict shoot growth can be beneficial.

Applied research also showed that certain post-harvesting practices had a strong suppressive effect on the development of bitter pit during cold storage. Golden Delicious apples that were pre-cooled for 24 hours to $-0,5^{\circ}\text{C}$ showed only a third as much bitter pit after five months of storage as similar apples that were pre-cooled for five days. The same reduction in the degree of bitter pit was obtained by dipping fruit in a 1 per cent solution of calcium chloride immediately before pre-cooling.

A new technique for preventing bitter pit, known as the Bangerth method, was tested. Apples were dipped in an ethephon solution immediately after picking and stored for 14 days at 20°C and 90% relative humidity, after which bitter pit counts were carried out. It was established that this method is fairly reliable for Golden Delicious apples, but not for Winter Pearmain.

It was recently determined that calcium accumulates in the fruit stalks in large quantities and that insoluble crystals containing calcium occur at the same time. This finding has opened up new fields of research on the causes of the immobilisation of calcium in this form and methods of preventing it. If this research is successful calcium should reach the fruit in adequate quantities and the bitter pit problem should become a thing of the past.

Pest control

Monitoring techniques using sex traps were investigated in order to determine the scale on which several important pests occur in pome and drupe orchards and investigate their activities. This research will make it possible to plan the judicious use of sprays at the right time in order to achieve effective control of pests at the minimum cost. These studies are already far advanced and in the case of the codling moth and fruit flies practical monitoring systems have been worked out and made available to the industry. The application of the system has already made considerable savings possible.

Sex pheromones which attract the leaf roller and false codling moth males are now available and the successful completion of further research will make it possible to determine the necessity for and the timing of control measures.

Attention was given to the control of snout beetles, which have recently become a serious pest in apple orchards. The best times to administer insecticides were established.

Investigation of the orchard mite problem continued and predatory mites were found in commercial orchards, which should be useful in the biological control of mites. Field trials produced an excellent new acaricide for the control of common red spider.

PEACHES

Biological control of crown gall

Crown gall is a major nursery disease characterised by galls on the roots of fruit trees. The pathogen is a bacterium, *Agrobacterium tumefaciens*, which can live a long time in infected soil, is spread by water and cannot be controlled by ordinary chemical means. It was recently found in Australia that crown gall can be controlled with the aid of an antibiotic substance secreted by the closely related bacterium, *A. radiobacter* Race 84.

This bacterium is administered as follows: the stones or cuttings are dipped in a water suspension of live Race 84 cells before being planted. This technique was tested by the Fruit and Fruit Technology Research Institute in pot trials against local crown gall isolates and the results were so promising that a commercial trial was carried out without delay. This trial was carried out with peach stones in infected soil. Almost 11000 peach seedlings were available after emergence and the young trees were ploughed up after nine months and examined for crown gall infection. Trees grown from these treated stones showed a 96% reduction in infection in comparison with trees grown from untreated stones. It was found, however, that Race 84 is only active against biotype 2 of the crown gall pathogen *A. tumefaciens*. An attempt was made to determine which is the predominant biotype in South Africa. Of the 40 or so South African isolates of *A. tumefaciens* tested so far, the majority belong to biotype 2.

TABLE GRAPES

New cultivars

A new early table grape cultivar which is pre-eminently suitable for the local market will shortly be released to the industry under the name of Bien Donné. Its most outstanding characteristics are the attractive appearance and even size of the straw-coloured berries and the ideal density and size of the bunches. The berries have a very pleasant, light muscat flavour and are almost totally resistant to cracking - ideal for the summer rainfall area. The vine is very fertile and grows vigorously.

The ampelographic evaluation of heat-treated scion material of several table grape cultivars that tested free of viruses was started. If evaluation does not reveal deviations the material can be handed over to the South African Plant Improvement Organisation for multiplication. A selected clone of the Salba table grape has already been made available to producers.

Improved colouring

Colouring was greatly improved, especially in Barlinka, an important cultivar, when the bunches were sprayed with dilute ethephon when the berries started to colour. The important practical advantages of this treatment, besides the general improvement in the colour, are that the crop can be



Typical manner of bearing of the new plum cultivar Martinelle

harvested in three to four pickings instead of seven to eight pickings and that the harvesting period can be extended by treating only selected vineyards. It is nevertheless important not to pick exclusively on the basis of colour but to make sure that the sugar:acid ratio of the grapes is correct.

Pest control

It was determined in the course of field trials that spraying programmes consisting of four sprayings against vine mealybug instead of three are not economically justified. An excellent new insecticide for controlling vine mealybug was found, but its registration was delayed on account of residue problems. It was also found that vinegar flies in table grapes can be controlled by means of fenthion spraying, as for fruit flies.

Pre-cooling of table grapes

The practice of storing table grapes in a polyethylene bag with a sulphur dioxide film appears promising. However, this type of pack reduces the rate of pre-cooling, which in turn causes delays at the cold stores at the docks.

Various pre-cooling rates and storage temperatures were tested in order to determine their effect on the keeping quality of grapes. After one season's work it was shown that pre-cooling to 4,5 °C does not have an adverse effect on the grapes, provided they are then stored at -0,5 °C. Even pre-cooling to 4,5 °C would help a great deal

to relieve the pressure at the pre-cooling rooms at the docks.

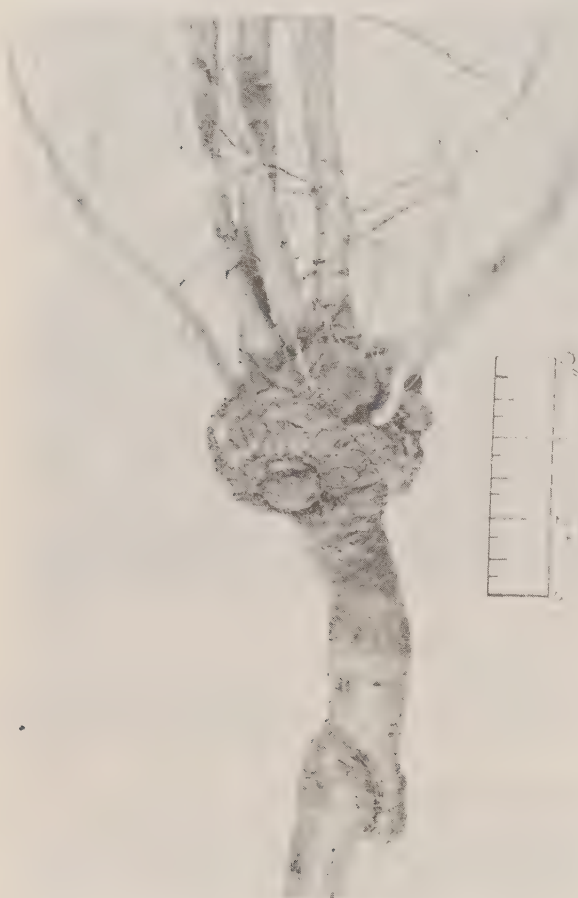
FRUIT PROCESSING

Production of dehydrated peaches without using sulphur dioxide

There are many consumers who, for health reasons, avoid dried or dehydrated fruit containing sulphur dioxide. Following research by the Fruit and Fruit Technology Research Institute it is now possible to prepare tasty dehydrated fruit from Elberta peaches without using sulphur dioxide. An investigation completed during the year under review revealed that undesirable darkening and changes in the flavour during drying can largely be eliminated by blanching the fruit in steam after stoning. To ensure that the product would have a good keeping quality it was necessary to dry the fruit to a lower moisture content. The result was a deterioration in the texture, but this problem was solved by treating the fruit with cane sugar before dehydration.

Since an attractive appearance is required in canned apricots and unevenness in the colour of the canned product has to be eliminated, pre- and post-harvesting techniques were tested with Bulda apricots to determine how they affected even ripening. It was found that a post-harvesting treatment with ethylene gas promotes even ripening but the canned apricots are then a very pale yellow.

A pre-harvesting spraying with dilute ethephon 14 days before the normal harvesting time caused the fruit to ripen evenly, with a golden colour and no green shoulders. It would therefore appear that pre-harvesting spraying can solve the colour problem in canned apricots, but more research is required to confirm this.



Crown gall infestation of young peach trees

ANCILLARY RESEARCH

Irrigation systems in the Western Cape

Owing to imperfect soil moisture distribution it may be undesirable to use a drip irrigation system on certain light-textured soils in the Western Cape. An investigation was therefore undertaken to determine which soil types justify the installation of this expensive system.

A method of predicting whether drip irrigation would be successful in various conditions has already been worked out. Further investigation revealed that the moisture distribution in light soils can be improved to some extent by using the pulse method, in which the water is applied at intervals instead of the usual continuous application.

STRAWBERRIES

New cultivars

The Fruit and Fruit Technology Research Institute plans to make a new strawberry cultivar

available in 1978 under the name of Tiobelle. This cultivar yields as well as Parfaite, but can be harvested earlier. Its freezing and canning qualities are far better than those of Parfaite. Since most strawberries have to be processed in factories early in the season in the Western Cape, the new cultivar should fill an important need in the industry.

Air transport

It is important that strawberries should be picked early in the morning and then refrigerated at 10 °C in a cold store for an hour before being packed for export. It has also been shown that it is necessary to send thermographs with consignments of export strawberries.

Differences in the quality of the three experimental consignments exported during 1976 were clearly due to their temperature histories. In one case where the fruit arrived overseas in an extremely poor condition it was shown that five days had elapsed between loading and delivery. Strawberries exposed to temperatures as high as 23 °C during the flight showed a very high degree of spoilage.

Summer rainfall area

PEACHES

Owing to the abnormally high prices early peaches fetch on the local markets (especially the Johannesburg market), there is a tendency among prospective and established peach farmers to plant the early cultivars Orion and Earlibelle on a large scale. The keen demand for the peach cultivars bred by the Department continued during the year under review.

In the Eastern Free State, where late frost is a problem, the demand for the recently bred Departmental cultivar Imperani was very good. During the past season the cultivar again proved that it is very well adapted in this area because it flowers so late in August. There was a keen demand for this peach on the Durban market this year and above-average prices were paid for the fruit. Surprisingly, although the trees were bearing too heavily this year, the fruit size was nevertheless satisfactory. It is anticipated that Imperani will become one of the most important dessert peaches in that area in time, although it is a yellow clingstone peach.

The yellow loosestone peach Clocolan also made a good showing in the Eastern Free State last season.

Breeding and selection

Thirteen of the 82 peach selections being evaluated in the Eastern Free State are considered promising. The selections flower fairly late in August and produce good crops of a high quality. A number of these selections are canning types that regularly flower late, do not produce underdeveloped fruit and have a better attachment than Keimoes, Walgant and Kakamas. How well



Insoluble calcium-containing crystals in the transport tissue of apple trees

these selections can still to be determined, however.

At Roodeplaat a yellow loosestone peach (selection 16-14) appeared promising for the third successive season. This selection bears very well and produces exceptionally large peaches. Over the past two seasons the average fruit size was 6,8 cm and the average crop per tree 123 kg.

Selection 551, which ripens early in November, also made a good showing in the Transvaal Middleveld. This yellow-fleshed semi-loosestone peach bears more regularly and produces bigger crops than Sunray, a peach of the same type.

CHERRIES

Cherry producers had a very poor year last season and the yield was estimated to be over 50 per cent below normal. This is ascribed to the high abscission rate among young fruit, and the consequent poor fruit set. The causes of this phenomenon are not very clear, but it is assumed that the very moist and cloudy weather conditions during the summer and autumn of 1975/76 had an adverse effect on fruit set. Losses from cold damage were minimal.

Interestingly enough, the new cultivar Van has not shown a very high abscission rate among young

fruit so far. In fact excellent yields were obtained from young trees of this cultivar. It is impossible to over-emphasise the importance of this property, because one of the problems of the cherry industry in the Eastern Free State is the fact that yields from the present cultivars fluctuate from year to year.

Major losses were also experienced in the Eastern Free State when cherry trees died as a result of the excessively wet soil conditions of the past two seasons.

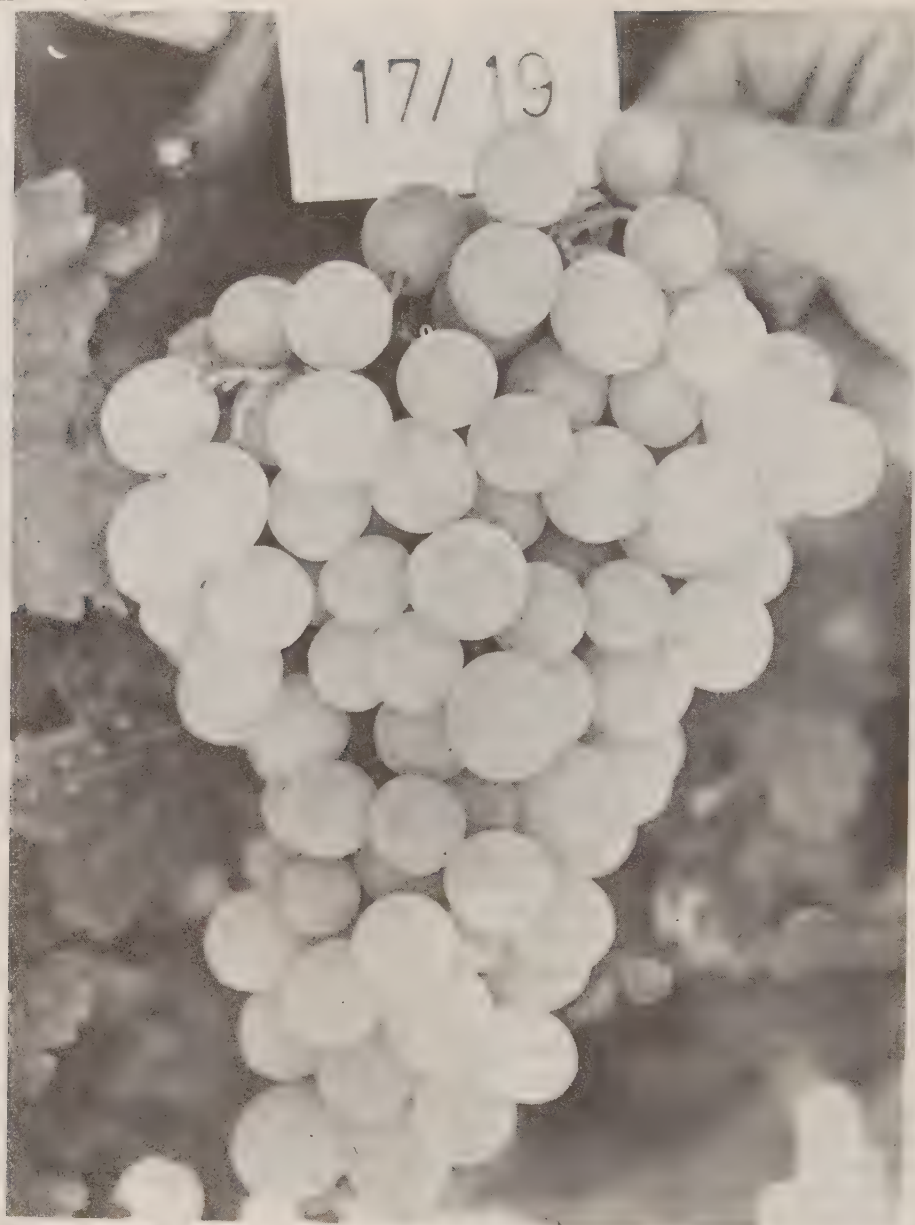
No major expansion in the cherry industry is anticipated in the near future. Producers are concentrating on renewing old, unproductive orchards.

Propagation studies

Propagation studies with cherry rootstocks have reached the stage where Mahaleb B40 and the Mazzard-hybrid Fb 2/58/48 can safely be recommended as rootstocks. Both rootstocks are easy to multiply by means of hardwood cuttings and have a good affinity with the scion.

A study has been undertaken to determine the most suitable planting date for hardwood cuttings. Preliminary data indicate that any time from the middle of May to the end of July is suitable for rooting hardwood cuttings successfully. Between 50

Typical bunch of the new
table-grape cultivar Albertine



and 80 per cent trees suitable for budding are obtained with Mahaleb B40 and Fb 2/58/48 when the cutting base is treated with 1000 ppm of indolebutyric acid.

TABLE GRAPES

There is still considerable interest in table grape farming, especially in the Warm Baths and Nylstroom areas. Some farmers intend to plant up to 15 000 vines this year and then expand later.

The serious shortage of locally grafted vines and rooted Jacquez rootstock material is delaying planting. Farmers are being compelled to import rooted material from the Western Cape. The drawback is that phylloxera and nematodes, which may not occur naturally in an area, can be imported in this way. As soon as virus-free plant material is established at Roodeplaat, healthy plant material will be supplied to the industry annually.

Grapes are being very successfully grown in the Hoedspruit area of the Lowveld. Three-year-old

vines bore for the first time this year and Pirobel ripened there on 1 November. Most cultivars ripened during November. The quality of the grapes under micro-irrigation was very good.

Downy mildew *Plasmopara viticola* was less serious in the summer rainfall area during the past season than it has been in previous years.

Breeding - A number of the 134 grape selections selected from the 6 000 seedlings planted in 1970 bore their first crop this year. One of the grounds on which these selections were made was apparent resistance to cracking. Eight of the selections were promising, the most promising being BAR/WC 70-1806, K/WC 70-4775, AL/WC 70-486 and AL/BAR 70-273.

Selection BAR/WC 70-1806 is a black grape with fairly large berries (5,0 g) which ripens with Queen of the Vineyard at the end of December.

Selection K/WC 70-4775 is a very attractive dark pink grape (Red Emperor colour) which

ripens in the middle of January. The berries are fairly large (5,3 g).

Selection AL/WC 70-486 looks very like Cardinal. The berries are very big (8,6 g) and do not easily crack. A month after ripening 78% of Cardinal's berries had cracked, as against 5% of those of the selection AL/WC 70-486. This selection ripens at the end of January.

Selection AL/BAR 70-273 is a pitch black grape that ripens just before Barlinka, at the beginning of March. This selection's berries also showed resistance to cracking, were large (8,2 g) and had the most attractive bloom of all the selections.

The early Barlinka type, selection 69-699, made a good showing for the third successive season. The grape ripened on 3 January this year. It again proved to have a high resistance to cracking. Researchers are considering releasing selection 69-699 shortly for cultivation in the summer rainfall area to replace Alphonse Lavallée.

Selection 17-19, an attractive straw-coloured grape bred by the Fruit and Fruit Technology Research Institute at Stellenbosch which ripens just before Queen of the Vineyard, again performed well. The selection is very resistant to cracking and although the berries are smaller (4,2 g) than those of Queen of the Vineyard, they are nevertheless marketable. Researchers are considering releasing this selection for planting in the summer rainfall area to replace Queen of the Vineyard and Golden City.

STRAWBERRIES

It is estimated that 100 hectares of strawberries were planted in the summer rainfall area during the 1975/76 season. About the same area was planted this year. Some of the established strawberry farmers planted from 5 to 20 hectares.

The production of strawberries in tunnels is still very popular and some farmers planted about 5 ha under cover.

The demand for plant material of the cultivars bred by the Department was very good. In the summer rainfall area the demand was as follows:

Selekta	58%
Parfaite	32%
Tioga	9%
Earlibelle	1%

Thirty new selections are being compared with the standard cultivars in respect of yield and early winter bearing.

PECAN NUTS

Despite last year's record crop the pecan nut trees at Roodeplaat again bore well. The average yield from the 10 best cultivars was 22,8 kg.

This year the cultivar Western Schley bore the best crop, with a yield of 34 kg per tree. The cultivar Moore, which produced the best average crop over a ten-year period, viz 31 kg per year, produced 29 kg this year. Since pecan trees are

inclined to bear in alternate years, this year's crop can be regarded as satisfactory.

Interest in growing the crop on a commercial scale is increasing annually. On the basis of trials carried out at Roodeplaat over the past 18 years, the cultivars Moore, Mahan, Barton and Success are now recommended for commercial cultivation in the Transvaal Middleveld and Highveld areas.

OENOLOGY AND VITICULTURE

During the 10-year period prior to 1973 the demand for natural wines grew at an average rate of 9,75% a year, but this rate has decreased gradually since 1973. In 1975 and 1976 the sales of fortified wines also dropped and brandy sales increased far more slowly than before. On the other hand the demand for alcoholic products not based on the grape increased steadily.

Whereas the demand for natural wines dropped, the production of wine grapes increased by an average of 3,5% a year during the 10-year period up to 1975. This growth was due chiefly to expansion of the area under wine grapes, since the unit production remained static in many cases or even dropped slightly. This tendency towards a decline in unit production was especially noticeable in the traditional areas. It may be ascribed partly to the use of soils with a lower potential and partly to the planting of high-quality cultivars that are shy bearing.

Owing to the decreasing demand, probably due chiefly to high prices and the generally unfavourable economic climate, and the increase in production, moderate surpluses can be expected in the short term. According to the original estimates supply and demand should be more or less in equilibrium again by 1981. However, these estimates will be greatly affected by the fact that the 1976/77 wine crop is about 25% lower. It is possible that supply and demand will again reach equilibrium before 1981.

The poor crop was caused by the very unfavourable climatic conditions during flowering (November 1976), which resulted in poor fruit set in many cultivars in several areas. The effect of the poor fruit set was aggravated by the outbreak of an epidemic of downy mildew - the most severe in the history of South African viticulture. In isolated cases downy mildew caused crop losses of up to 100%; the crop loss for the industry as a whole as a result of this disease is estimated at 5% to 10%. The chief cause of the epidemic was the very wet weather experienced in spring and early summer in the Western Cape. This promoted the spread of the fungus and hampered preventive spraying considerably.

Because there was a possibility that the wet, cloudy and cold conditions, especially during November 1976, might have resulted in abnormally low fertility in vine buds that differentiated in that period, the Oenological and Viticultural Research Institute (OVRI) collected shoot samples of the most important commercial cultivars from 30 areas and analysed the buds under a microscope. It was found that the fertility had been affected and that



Wine samples examined microbiologically

there were major differences between the cultivars and areas. Meetings were held in the various areas to inform producers and recommend methods of adjusting winter pruning to counteract the reduced fertility. There was exceptional interest and over 1 000 producers attended these meetings. The Institute is to hold a similar series of meetings for producers in August and September 1977 to discuss the whole question of disease control, with special reference to downy mildew, since there is a very large winter spore population of the fungus which could have catastrophic results if another wet spring were experienced.

One of the fundamental problems of the wine industry is the low unit production - and this is a problem which is all the more serious in view of the steadily rising production costs. Improved production techniques could help considerably and a great deal of attention is being given in the Institute's research programme to pruning, trellising, soil cultivation and irrigation.

Improved plant material could make the greatest contribution to higher production, however. Good progress is being made with the testing of heat-treated material and the release of adapted cultivars for use in the industry. During the year under review 9 scion cultivars and one rootstock cultivar were made available to the Wine Grape Multiplication Organisation. Propagating material of these cultivars should be available to the industry within a few years.

VITICULTURE

Cultivar evaluation

Scion cultivars: First phase

During the past year the plant Protection Research Institute (PPRI) handed over the following material, which had been in quarantine to the OVRI for evaluation: 10 new cultivars, 11 clones of eight locally known cultivars and 18 crossings from Davis, California. To date just over 200 cultivars and clones have been imported by the OVRI since its establishment, 189 of which have been established at the Institute. Twenty-two of their own promising wine grape crossings were received from the Faculty of Agriculture of the University of Stellenbosch for evaluation.

During the past season data on 48 new cultivars were collected at Nietvoorbij. The cultivars which performed best from the point of view of both viticulture and oenology were Pinot gris, Morio Muscat, Fernao Pires, Harsleyveli, Nemes Furmint, Vital and Bourboulenc. They are being evaluated together with Rabaner, Mausenc blanc, Witberger and Reichensteiner, which also appeared promising, with a view to second-phase evaluation at Departmental research stations at Lutzville, Robertson, Oudtshoorn, Upington and Vaalharts and on the farms of several farmer collaborators in interplanting trials.

Scion cultivars: Second phase

The cultivars Flora, Emerald Riesling, Bukkettraube, Chenel, Weldra (K2), Colombard, Chenin blanc and Burger (Monbadon) performed very well at the Robertson Research Station, from the point of view of both viticulture and oenology. They are recommended for commercial cultivation in this area.

Rootstock cultivars: First phase

Another five imported rootstocks were removed from quarantine during the past year and handed over to the OVRI for establishment, multiplication and evaluation. Thirteen rootstock crossings were also received from the Faculty of Agriculture, University of Stellenbosch, which brings the number of new rootstocks for preliminary screening to 72.

Rootstock cultivars: Second phase

In a six-year-old rootstock trial on red sandy soil on a Departmental experimental plot next to the Olifants River (near Lutzville) in which 13 of the best known rootstocks are being tested with Chenin blanc as the scion, 101-14, Richter 110, Metallica, Richter 99 and Salt Creek produced the best yields this year. Each of these rootstocks yielded over 20 tons per ha.

In a similar co-operative trial on heavy silt in the same area which is in its seventh year and in

which 10 rootstocks are being evaluated with Chenin blanc as the scion, yields of considerably over 50 tons per ha were obtained last season. The rootstocks that produced the best results were Richter 99, 143B, Rupestris du Lot, 101-14 and Salt Creek.

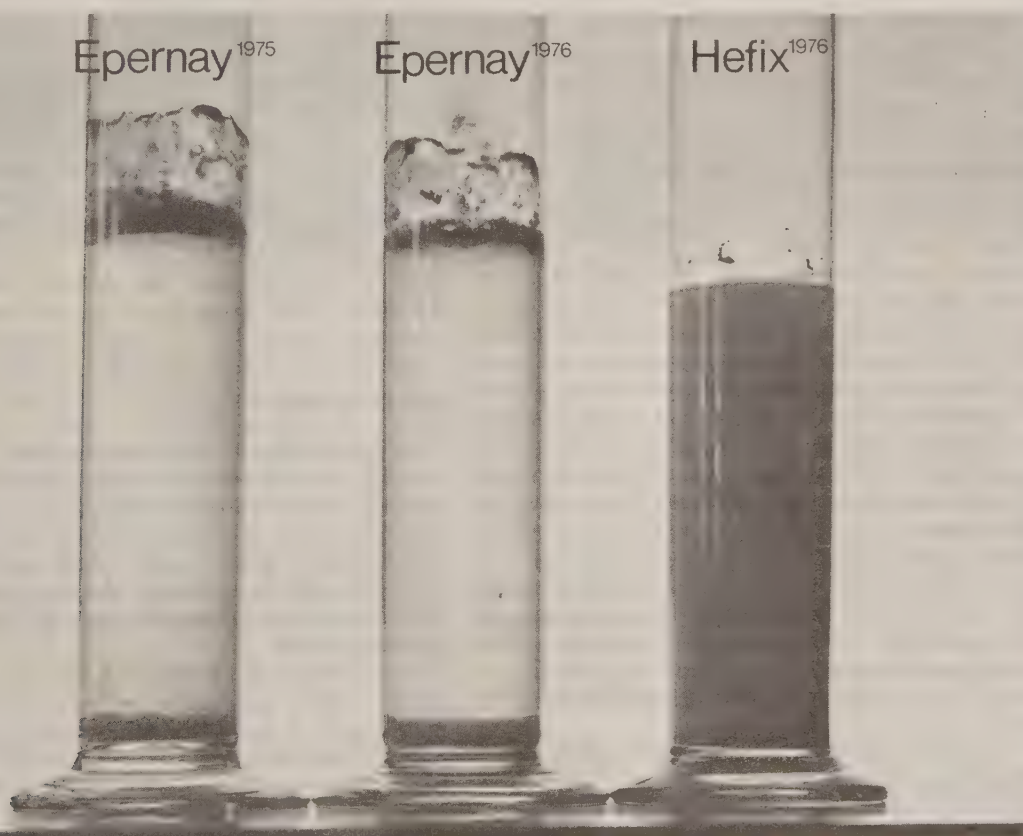
Virus purification of cultivars

Scion cultivars

During the past year material of another 46 clones of 40 imported and local scion cultivars was handed over to the PPRI (Stellenbosch) for virus purification. At present 155 clones and cultivars are in the process of undergoing virus purification. The material of 12 clones and 10 cultivars has already been indexed virus-free for a third season (a cultivar must test clean for three seasons) and has been handed over to the OVRI for ampelographic testing with a view to releasing it to the industry after it has been multiplied by the Wine Grape Multiplication Organisation. The 10 cultivars are Colombard, Clairette blanche, Chenin blanc, Cinsaut blanc, Cinsaut (3 clones), Gamay noir, Grenache blanc, Palomino fino, Riesling and Weisser Riesling 239.

Material of the following cultivars which tested virus free for two seasons was also handed over to the OVRI for ampelographic testing: Pinotage, Chenin blanc (2 clones) and Sultana.

Cultivars found free of viruses for one season and handed over for ampelographic testing include



The Epernay yeast strain shows typical frothing characteristics: stable froth head, few yeast cells in suspension and a layer of yeast cells at the bottom, in contrast to Hefix which is non-frothing

Cabernet Sauvignon, Chenin blanc, Semillon, St Emilion and Korente (two clones).

Rootstocks

A further 17 imported clones of 15 cultivars and 10 local crossings from the University of Stellenbosch were handed over to the PPRI (Stellenbosch) for virus purification during the past year. Fifty-five rootstock clones and cultivars are now in the process of virus purification. The following cultivars were handed over to the PPRI for ampelographic testing: Paulsen 1103 and Coudere 161/49, which tested virus free for three seasons, Berlandieri 13/3 and 13/5, Castell 216/3, Paulsen 775, Jacquez BD1, Ruggeri 140, Salt Creek SO₄, 101-14 and 143B, which tested virus free for two seasons, and Richter 110, which tested virus free for one season. Virus-free Paulsen 1103 has, like Jacquez, Richter 99, 101-14 and 143B, been handed over to the Wine Grape Multiplication Organisation for multiplication and eventual release to the industry.

Release of imported scion cultivars

At the recommendation of the OVRI and the Co-ordinating Committee for the Evaluation of New Cultivars the Department recently announced that the following cultivars are being handed over to the Wine Grape Multiplication Organisation for multiplication and distribution to the industry: Pinot gris, Morio Muscat, Fernao Pires, Harslevelii (pecs 41), Nemes Furmint, Vital Bourboulenc, Emerald Riesling and Burger (Monbadon). It will necessarily take about five years before graftwood of these cultivars will be available on a commercial scale.

Grafting and nursery practices

Because of the need to renew exhausted vineyards and the scarcity of superior planting material of new cultivars and virus-purified clone material, research on propagating material remains essential, and a variety of practical grafting and nursery techniques were therefore investigated.

Although it is a more time-consuming process and requires considerably more skill, hand grafting produces better results than machine grafting, but owing to the increasing shortage of skilled grafters the use of machine grafting will have to continue. It has been found, *inter alia*, that the Omega grafting machine used for the past few years by an increasing number of nurserymen produces as good results as the older saw cut grafting machine. If grafting material is kept in cold storage under hygienic conditions up to the time of grafting, no problems are foreseen with machine grafting in future.

There is considerable room for improvement in the quality of the nursery-grafted vines encountered in the nursery industry at present, especially with regard to the graft unions. Results have shown that better grafted vines are obtained by using pre-callused vines, although this does not

necessarily guarantee a higher percentage take in the nursery.

Promising results were also obtained in the nursery by using a temporary plastic soil cover over the earthed up bank for uncalled vines, and a permanent plastic soil cover for callused vines whose graft unions are left above the covered surface of the soil. This appears to be a practical and economic solution where soils would otherwise not be suitable for nursery purposes.

Cultivation

Bud fertility

One of the most important factors that determine the size of a crop is the fertility of the fruit buds of vines. The fertility of the buds is determined in spring about 15 months before the harvest and depends chiefly on climatic factors such as temperature and sunshine.

During November 1976 the average daily duration of sunshine was about 3 hours less than normal, and the average daily temperature about 3°C lower. Because of the unusually low temperature and duration of sunshine in November 1976 when the buds that will determine the 1978 harvest were being formed, the OVRI investigated the bud fertility of the most important cultivars in 30 areas throughout the winelands of the South-Western Cape. In all about 4 000 vine buds were analysed under a microscope. The results showed that the fertility of the fruit buds had been affected, and that the degree to which it had been affected differed enormously from area to area and cultivar to cultivar.

The average bud fertility, taken over all the areas, of the most important cultivars, such as Cinsaut, Steen and French, was 15% to 20% lower than during the 1976 season and that of Cabernet Sauvignon 29% lower, but the cultivars Colombard and Pinotage showed no decline in fertility. It was found that on average 20% of the fruit buds were dead or infertile, and that fertility increased from the basal buds of a shoot to the sixth or eighth bud.

Soil cultivation

An intensive investigation into the effect of various cultural practices under dryland conditions showed that moisture conservation during the early part of the growing season is of cardinal importance to the vine. All weeds and winter cover crops should be killed by the end of August and the vineyard kept free of weeds for the rest of the growing season.

Covering the surface of the soil with inactive plant residues was shown to have great advantages in respect of both moisture conservation and a more favourable soil temperature. Competition between permanent cover crops and the vines for nutrients, particularly nitrogen, was the cause of weaker shoot growth under irrigation. In dryland vineyards the competition caused fermentation problems in addition to weaker shoot growth.



Micro-scale wine-making at the experimental cellar at Nietvoorbij

Co-operation with a visiting German viticulturist underlined the importance of providing better "lebensraum" in vineyards that have become compacted or been poorly prepared. The recommended practice involves root pruning and loosening of the soil inside the compacted tractor tracks where re-compaction will not readily occur, in contrast to the usual practice of loosening the soil outside the tractor tracks. Re-compaction of the soil by tractors and implements prevents the roots from utilising the soil between the tracks.

Soil preparation

Root studies in a soil preparation trial at Nietvoorbij showed that the vine root is unable to utilise the dense subsoil of a Hutton soil, but merely grows and branches in the loose zones created by the various implements. Consequently if the preparation of the soil is inadequate a large soil

volume, and therefore a large potential source of moisture and nutrients, remains unutilised. Investigation of the soil preparation problem is continuing in a new field trial at Nietvoorbij. An attempt is being made in this trial to correct the undesirably high degree of acidity of the subsoil with the aid of various types and levels of ameliorants during soil preparation with various types of implements and at various tilling depths, and to stabilise and maintain the favourable new physical soil conditions.

Soil type and wine quality

Further investigations into the effect of soil type on wine quality have shown that where there is no irrigation or only supplementary irrigation the hydromorphic soil properties play an important part. Vineyard soils in the Western Cape differ drastically in this respect. Everything points to the

fact that the soil does not necessarily influence the grape directly, but that the composition of the grapes and therefore the quality of the wine can be influenced by the effect of the soil on the vegetative growth, which determines the extent to which the grapes will be protected from or exposed to high temperatures and other climatic elements. The crop per vine also has a decided effect on wine quality, especially in the case of quality-sensitive cultivars. More intensive research on this matter is being undertaken.

Fertilising studies

The first phase of a pot trial in which the seasonal uptake of nutrient elements is determined quantitatively has been completed. It appears that most elements are still actively absorbed right up to leaf drop. In the case of 2-year-old vines it was found that the quantity of nutrients absorbed during the post-harvesting period amounts to an average of only 20% of the seasonal total. Total nutrient reserves in the permanent parts of these vines were 60% higher, on average, at the end of the second season than at the end of the first year.

After three seasons of differential fertilising in a field trial with fertilisers at Nietvoorbij there were indications that N, P and K fertilising were starting to affect shoot growth. However, no influence on yield has yet been observed. The research is continuing.

Chemical weed control

The search for better weedkillers for vines is continuing. All ten weedkillers registered for use in vineyards have shortcomings in respect of their ability to control weeds effectively or their safety for use in vineyards, quite apart from the cost aspect. About 50 pre-emergence and 30 post-emergence preparations were evaluated from this point of view. The following weedkillers were found to be the most useful.

Pre-emergence preparations

- (a) Against seedling weeds: Simazine, a half strength simazine-nitralin mixture, napropamide, difenamid and terbutylazine. The preparations fluometeron, oxyfluorfen, norflurason, Ustilan and U27267 provide broad-spectrum control against weeds but are borderline cases from the point of view of soil residual safety in sandy soils under irrigation. To the list of safe and effective pre-emergence weedkillers can be added mixtures of the ten preparations that control grasses (such as the nitro-amylenes) and three preparations used to control chiefly broad-leaved weeds.
- (b) Against nutgrass: Pre-emergence weedkillers of which vine roots are tolerant and which produced satisfactory to good control of the emergence of nutgrass tubers when worked into the soil included anthor, metolachlor, EPTC, perfludone, alachlor and napropamide. The only one that produced satisfactory

control when worked in during sprinkler irrigation was perfludone.

- (c) Against other perennial weeds: the pre-emergence preparations dichlobenil and norflurason produced reasonably satisfactory control of certain types of quickgrass and field bindweed, via the roots. However, they are both borderline cases in respect of safety for vines.

Post-emergence weedkillers

A variety of weedkillers, with a safe soil-residual action in vines, are able to kill any plant parts with which they come into contact. These preparations include bendioxide, bromoxynil, bromfenoxim, dinoseb, diquat, glyphosate, HOE29152, monolinuron, morfamquat, MSMA, oxadiazon, oxyfluorfen and terbutryn. However, these weedkillers differ greatly in the spectrum of the weeds they can control and the degree of systemicity. Diquat and paraquat are non-systemic preparations with the broadest spectrum of control but because of their contact action they can only be used against annual weeds.

In order to kill the extensive root systems of perennial weeds such as quickgrass effectively, the maximum systemic action, such as glyphosate provides, is required, or regrowth will take place. None of the above preparations has a control spectrum and systemicity that can be compared to those of glyphosate. The closest for the control of perennial grasses such as quickgrass is a mixture of HOE29152 and oxyfluorfen. Perennial broad-leaved weeds such as field bindweed, hound's tongue and volunteer lucerne are most cheaply controlled by means of MCPA, the efficacy of which can be considerably improved by the addition of bendioxide. This mixture even provided satisfactory post-emergence control of nutgrass for a few months.

OENOLOGY

Disease control

Hot water treatment of vines against *Phytophthora cinnamomi*

Research in connection with the hot water treatment of rooted young vines as well as vine shoots for the control of *P. cinnamomi* was continued. There was complete control of the fungus with immersion periods of five to 30 minutes in hot water at 50°C. Vines planted directly after the treatment showed no signs of phytotoxicity, and after eight months of growth the root mass, shoot mass and shoot length of all the treated vines were better than those of the control vines. The highest root and shoot masses and the longest shoots were found in vines treated for 15 minutes. A 15-minute treatment at 50°C will therefore be recommended in future.

New fungicides against downy mildew

Downy mildew was very severe during the past season and created ideal conditions for testing



Elsenburg wines now have their own labels for the first time

new fungicides. Three systemic preparations were tested and the findings show that they provide better control than the standard preparations.

CGA 48988 reduced the leaf infection to 3%, as against 76% in the control. DPX 3217 reduced the leaf infection to 2,36%, as against 49,4% in the control and 11,48% in the case of a standard preparation. The third preparation, Aliette 1710, reduced infection to 4,12%, as against 67,2% in the control and 15,8% in the case of a standard preparation.

These preparations therefore undoubtedly provide very good control and have the additional advantage that they do not easily wash off. Unfortunately they will not be available during the coming season.

Effect of phenols on the quality of red wine

The investigation into red wine colour phenols is a basic section of a broad study on the compounds in wine that determine quality. The phenol fractions separated included one that showed a highly significant correlation with astringency in young wines and which appears to be responsible for this property of wine.

The colour of a red wine is inclined to influence a judge very strongly, especially with regard to trueness-to-type, purity and flavour. In this study the bouquet and taste properties of red wines were found to be responsible for about 74%

of the variation in quality, with colour accounting for 92% of this variation.

The findings indicate that very few of the phenolic compounds in wine come from the skins. This means that wine quality cannot be predicted from the grape polyphenols. It should be emphasised that fermentation greatly modifies the grape components that affect wine quality.

Optimum ripeness in grapes

Data on the optimum ripeness of Chenin blanc grapes at Stellenbosch and Colombard grapes at Robertson, studied in conjunction with data obtained the previous year, showed that a sugar:acid ratio of about 2,5 is a useful indicator of ripeness. In the case of Colombard it was also found that skin contact makes it possible to make good quality wines from grapes not yet "ripe" enough to yield good quality wines by the free-run method, without skin contact. In this way the period of optimum ripeness can be extended by two to three weeks.

Pinotage grapes from a certain vineyard at Stellenbosch harvested at the stage of optimum ripeness produced wine of the highest quality for two successive years at a sugar:acid ratio of about 4,2.

This investigation, which could contribute to the improvement of wine quality, underlines the fact that the sugar concentration of grapes cannot indicate the optimum ripeness with the necessary

precision. Due consideration should be given to the acid concentration as well.

Factors that affect the formation of esters in must

Indications in data obtained last year were followed up and the effect of air on the formation of esters during grafting was investigated in more detail this year. It was established that air greatly accelerates the formation of esters in clear musts, although the opposite was found in settled musts. Must turbidity and artificial turbidity were investigated in this connection. The addition of as little as 10% of settled must to clear must raises the ester content considerably. Here the effect of the particular particles is more positive than that of air. The addition of up to 2% of settled lees to clear must has the same effect as the addition of settled must. However, if 5% or more of lees is added, the ester content drops considerably.

The artificial production of turbidity in clear must with the aid of bentonite resulted in considerably lower ester formation than is usual in a clear must. Bentonite had the opposite effect to that of natural small turbid particles.

These studies, based on recognised winery techniques, provide particularly valuable clues with regard to the definition of the effect of these techniques on wine quality.

Active dry yeast for the preparation of wine

The results of continued trials with commercial dry yeast, used to make wine on a semi-industrial scale, are summed up in the following table:

Yeast strain	Wine quality (expressed in percentages)			
	13 °C		17 °C	
	0,4 g of yeast/l	2,0 g of yeast/l	0,4 g of yeast/l	2,0 g of yeast/l
Epernay	65,0	64,7	64,9	57,1
Strain 228	53,7	43,2	53,0	36,6
Hefix 1 000	61,0	50,7	60,9	50,1
WE14 (control)	67,6	-	64,5	-

At the recommended concentration (0,5 g of yeast/l) dry yeast can be used at higher temperatures (15 to 17 °C) than the conventional 10 to 10 °C to make white wines, with no reduction in the wine quality. The use of a higher temperature reduces the fermentation period by 30%.

A so-called bulk inoculum (2,0 g of yeast/l) is undoubtedly prejudicial to wine quality, particularly when a higher fermentation temperature is applied as well.

The yeast strain 228 produces a neutral wine and therefore cannot be recommended for making high quality wines, but because this strain results in a very "clean" fermentation (short fermentation period, low volatile acid production), it is very suitable for making rebate and even distilling wines.

Serious problems with foaming were experienced at 11 wineries in the Worcester/Robertson area with the dry yeast Epernay. Laboratory trials showed that this yeast undoubtedly contributes to foaming. Epernay can therefore not be recommended in areas where problems with foaming are sometimes experienced.

Nitrogen deficiency in must and retarded fermentation

Retarded (incomplete) fermentation occurred during the past year in must derived from a vineyard block at Nietvoorbij where no cultivation was applied. Analysis of the must showed that this must had an inadequate nitrogen level (163 mg of normal nitrogen content (473 mg of N/l). After the addition of (NH₄)₂ HPO₄ to the must with a low nitrogen level fermentation proceeded normally.

This finding has far-reaching practical implications since the sod culture of vineyards in summer tends to promote competition between weeds and vines for water and nitrogen. The result is that in many cases the grapes delivered to wineries have too low a nitrogen content, which could cause retarded fermentation. In the case at Nietvoorbij the vineyard did not show obvious symptoms of a nitrogen deficiency, but the must contained too little nitrogen for complete fermentation. The investigation is being continued.

Effect of temperature on wine yeast fermentation and metabolism

Controlled fermentations at 15 °C to 16 °C, or below these temperatures, lead to higher CO₂ concentration and to an increase of viable yeast cells in the wine. Oxidation reduction potential is in inverse proportion to the rise in yeast population and, consequently, is lower in cold fermented wines. During stabilisation these wines require less SO₂.

Fermentation temperature at 15 °C, compared with 25 °C, increased the alcohol slightly (0,25 vol. per cent) and the glycerol and extract considerably (1,36 g/l and 0,91 g/l respectively). Acetaldehyde was lower at a fermentation temperature of 25 °C.

As a result of yeast activity no direct correlation could be found between the wine constituents studied. Controlled fermentation at 13 °C and 17 °C had no significant effect on dry white wine quality. For this type of wine fermentation at 15 °C to 16 °C is to be preferred to lower temperature, used in some wine cellars.

Heavy metal content of South African wines

Besides the rate of solubilisation and combination of the physically dissolved molecular oxygen, which were studied in fresh must and young wines, the heavy metal contents of 56 South African white and red wines were analysed. From

copper, manganese and zinc catalyse oxidation makes wine highly unstable. Our survey demonstrated that the heavy metal content of South African wine is low. Some white wines from the Robertson and Tulbagh areas, however, have an excessively high iron content (8 to 14 mg/l). For proper ageing of these wines, removal of heavy metals is advisable.

Malolactic fermentation

Preliminary investigations were carried out to prevent and to induce malolactic fermentation. Part of these experiments is organised in the Institute wine cellar on two varieties: Cabernet and Pinotage. Shiraz, Pinotage and Cabernet were also studied under commercial conditions on a wine estate.

The first results show that, owing to the high pH of South African red wines, malolactic fermentation must be given special attention. If not induced, malolactic fermentation occurs during ageing in an uncontrolled way, which might lead, in certain cases, to the increase in volatile acidity. If it is induced only known bacteria can be used. Inoculation must be done after the alcoholic fermentation is completed and no unfermented sugar is left in the wine.

It seems that induced malolactic fermentation improved wine quality. For a final conclusion, however, more investigations are needed.

Microbiological services

The tendency to switch to commercial dry yeast is still evident in that only 25 bodies made use of the Institute's selected yeast service. On the other hand the Section received 145 wine samples for biological quality control tests during the period July 1976 to July 1977. This 30% rise in the number of samples is an indication of concern among wine-makers about malolactic acid fermentation in bottled red wine and the fact that there is now no legal chemical preservative on the market for use in the preservation of semi-sweet wines.

Thermovinification of Cinsaut grapes

Cinsaut grapes from Rawsonville with sugar and acid concentrations of 20,5 °B and 5,2 g/l, respectively were processed as follows at the Nietvoorbij experimental winery:

- The grapes were allowed to ferment conventionally at 18 °C without pre-dejuicing and with 30% and 50% juice extraction before fermentation.
- The grapes were heated to 70 °C and fermented at 15 °C without pre-dejuicing and with 30% and 50% juice extraction before heating.

The results showed that heat treatment together with juice extraction before fermentation produced considerably better wines than those made in the conventional way with juice extraction before fermentation.

No significant differences were found between wines made by heat extraction after 30% juice extraction before fermentation and those made after 50% juice extraction.

Heat extraction wines not only had a better colour but were very well-rounded and true-to-type and better balanced than wines made in the conventional ways.

Mechanical harvesting of Riesling

Certain parameters such as temperature of the grapes at harvesting, material other than grapes (MOG) deposited with the grapes during the harvesting process and the period for which mechanically harvested grapes were stored before processing, were investigated separately and together in mechanically harvested Riesling grapes. The grapes were harvested at high (27 °C) and low (17 °C) temperatures and with high MOG (11% of the total crop mass) and low MOG (3% of the total crop mass) and kept for 1 and 18 hours before processing.

The results show that with the harvesting of South African Riesling the MOG should be kept as low as possible since it has an adverse effect on the wine quality, irrespective of whether the grapes are harvested at low or high temperatures.

It is, however, important that mechanical harvesting should take place at low temperatures, because high harvesting temperatures have an adverse effect on wine quality, even with low MOG contamination and a short storage period. The grapes should also be processed as soon as possible after harvesting since wine quality is adversely affected by long storage periods.

Liquor control

Certification of wine in terms of Act 25 of 1957

Table 1 shows the quantity of the various types of wine certified for sale by the Wine and Spirits Board during the year under review. The origin, grape cultivar and/or vintage are indicated.

TABLE 1 - Certification of wines of origin and cultivar and vintage wines

Type of wine	Total certified	Superior quality		Special quality	
		h/	%	h/	%
Unfortified wines	102 013	1 816	1,78	100 197	98,22
Liqueur wines and other fortified wines	75 871	352	0,46	75 519	99,54
Total	177 884	2 168	1,22	175 716	98,78

It is interesting to note that 5,7% by volume of the wine certified during the year under review, calculated as a percentage of the total sales (local consumption as well as exports) during the same period was unfortified wine and 0,6% fortified wine.

Inspection of wine spirits and rebate brandy

The activities of the Government Brandy Board with regard to the compulsory inspection of all products of the vine for quality are reflected in Table 2.

TABLE 2 - Certification of rebate wine, rebate brandy and wine spirits

Type of wine or spirits	Total inspected		Approved hℓ	% rejected, by volume
	Samples	hℓ		
Rebate wine	1 929	958 790	904 479	5,7
Rebate brandy	468	123 242	120 046	2,6
Wine spirits	718	268 726	262 607	5,0
Low-strength spirits	71	1 515	1 515	-

It will be observed from Table 2 that the volume of rebate brandy (120 046 hℓ) approved was 29,3% lower than during the previous year. This decline is due chiefly to the fact that record quantities of rebate brandy were distilled during the previous two seasons to supplement the serious shortage of matured brandy experienced in 1974. Consequently the total stock of rebate brandy undergoing maturation had been built up to the point where it was not considered desirable to carry on at the same rate this year, especially since storing rebate brandy involves major capital expenditure.

With regard to the quality of the rebate wines and distillates submitted to the Board for selection, a good general standard was maintained by winemakers and distillers. This is evident from the fact that the percentage of rejections shown in Table 2 does not differ significantly from that of the previous year.

Quality control of export liquor

The Wine and Spirits Board inspected 1 893 samples of export liquor, representative of 125 947 hℓ of wine and spirits, for quality under the Liquor Export Regulations. 1 878 samples, representative of 125 883 hℓ, were certified as being suitable for export. The percentage rejections, calculated according to the number of samples and the volume, were 0,8% and 0,05% respectively. In view of the high standard of quality set by the Board, this low percentage of rejections is evidence of the high quality of the South African wines offered for export.

The total volume exported was nevertheless 10,5% lower than the volume exported last year, which in turn was down by 8,4%.

Control of imported liquor

602 consignments of imported liquor, imported under provisional certificates of removal in terms of Act 25 of 1957, were sampled at clearing houses in order to check the chemical composition and labelling.

In all 657 new applications for certificates of removal for the importation of liquor were

considered, and 546 were approved. The remaining 111 were rejected on the grounds of non-compliance in respect of chemical composition and/or labelling.

Liquor inspection services

Under the Wine, Other Fermented Beverages and Spirits Act, Act 25 of 1957, liquor inspectors are responsible for the inspection of licensed premises where liquor is manufactured or sold. In all 1 815 premises were inspected, and inspectors travelled 80 652 kilometres and tested and examined 75 522 samples on these premises. They took 356 samples in doubtful cases and submitted them to the OVRI for further examination and chemical analysis. These examinations resulted in nine court cases. Two licensees were convicted and fined, one was acquitted and one case was withdrawn. In four cases the licensees admitted guilt and paid the fine and one case is still pending. Six licensees were cautioned about minor offences.

Two inspectors specially appointed to supervise and inspect all activities of the KWV with regard to the manufacture of certified wines visited the premises of the KWV virtually daily.

Similar control was exercised over certified wines manufactured by all other co-operative wineries and wine estates by a special administrative division and the inspectorate of the KWV, which performs this service on behalf of the Wine and Spirits Board on a contract basis. In the case of wholesalers this service is performed by the Department of Customs and Excise.

Routine analytical services

The routine analysis laboratory of the OVRI, which is responsible for all official analyses carried out for monitoring purposes under Act 25 of 1957 and other acts relating to alcoholic liquor, and for providing a liquor analysis service for the industry, analysed 11 442 samples of liquor during the year under review.

CITRUS

Breeding

A number of techniques which could fruitfully be applied in local citrus breeding programmes have been developed. Two methods, based on cotyledon colour and the sensitivity of seedlings to the insecticide dimethoate, can be used to identify the relatively large percentages of sexual seedlings in certain crossing combinations.

A method was also developed by which the production of sexual seedlings by polyembryonic female parents can be stimulated. About a month after pollination the young fruit are dipped in highly concentrated gibberellic acid (15 g/l). This treatment greatly increases the percentage of sexual seedlings in relation to nucellar seedlings. It was also found that the treatment of fruit with gibberellic acid at too early a stage, namely from

before anthesis to about two weeks after anthesis, leads to a reduction in the production of crossings.

Replanting problem

Field trials show that methyl bromide fumigation of old citrus soil is the most effective nematocide, improves tree growth and increases potash uptake.

Trials are being carried out under controlled conditions at present with the purpose of making an in-depth study of the various factors involved in the replanting problem. It has been found that the rate of root growth is an effective criterion by which to determine the response of rootstocks to certain chemical components in the soil within two weeks. The possible effects of organic toxins in citrus soil are being investigated.

Production of virus-free citrus seedlings

Another 6,5 hectares of citrus seedlings was planted at the Messina experimental farm during the past season. In all there are 1 564 seedlings, comprising 251 cultivars and selections, growing there.

The evaluation of the bearing trees at Messina has progressed so well that 86 cultivars and selections have already been multiplied by

vegetative means and established in foundation blocks on a separate part of the experimental farm.

As soon as the first budded generation produces fruit, buds will be taken from these trees for the propagation of experimental trees. The experimental trees will be compared in trials with the best trees at present used by the industry as parent trees in the interim citrus improvement scheme.

There are a further 80 cultivars in the seed beds ready for transplanting in the coming spring.

Chemical weed control

It was confirmed that where glyphosate is used on its own or is followed up by diuron, the crops are higher than in the cultivated control. The combination controlled all weeds in the experimental plots. Buffalo grass, for instance, was not controlled by bromacil or diuron, but glyphosate proved effective. This preparation is expensive but treatment with glyphosate resulted in a very good crop, which justifies the cost.

Bromacil, diuron, paraquat and glyphosate are recommended for use in citrus orchards. All these preparations are registered.

Irrigation

The results obtained with microjets in citrus orchards indicate the following constant responses:



The Citrus and Subtropical Fruit Research Institute celebrated its golden jubilee by holding an open day on the premises of the Institute. The photograph shows the Minister of Agriculture, Mr Hendrik Schoeman, and part of the large number of people who attended

1. The production of trees increases if the cycle is reduced from 14 to 3 days.
2. The production of trees increases if the crop factor is raised from 0,45 to 0,67.
3. Fruit quality is improved by extending the cycle on 1 April from three days to 14 days.
4. The production of trees is better with micro-irrigation than with drip irrigation. The same volume of water was applied in both cases, at the same frequency.

Citrus diseases

One of the most serious citrus diseases in the Transvaal is greening. Over the past few years research has shown that a certain degree of control can be obtained through a single application of the antibiotic tetracycline hydrochloride by the trunk injection technique.

Preliminary trials have now been conducted in which, instead of a single injection, injected trees are given a continuous treatment for seven days. In this way it was shown that it is possible to cure a tree of greening disease.

Since the late 1960s, grapefruit trees in the Nkweleni district of Natal have been showing symptoms of citrus impietratura disease. In 1977 similar symptoms were found on grapefruit in the Eastern Transvaal and on Washington navels in the Eastern Cape. All the grapefruit trees were traced back to a single nursery, now no longer in operation. Indexing tests on these trees using sour orange seedlings have confirmed that the disease is impietratura.

By indexing for exocortis and psorosis viruses in budwood source trees in the Citrus Improvement Programme, it was found that about 20% of the trees were infected with exocortis.

Testing and selection of *mycorrhizal fungi* for citrus are under way.

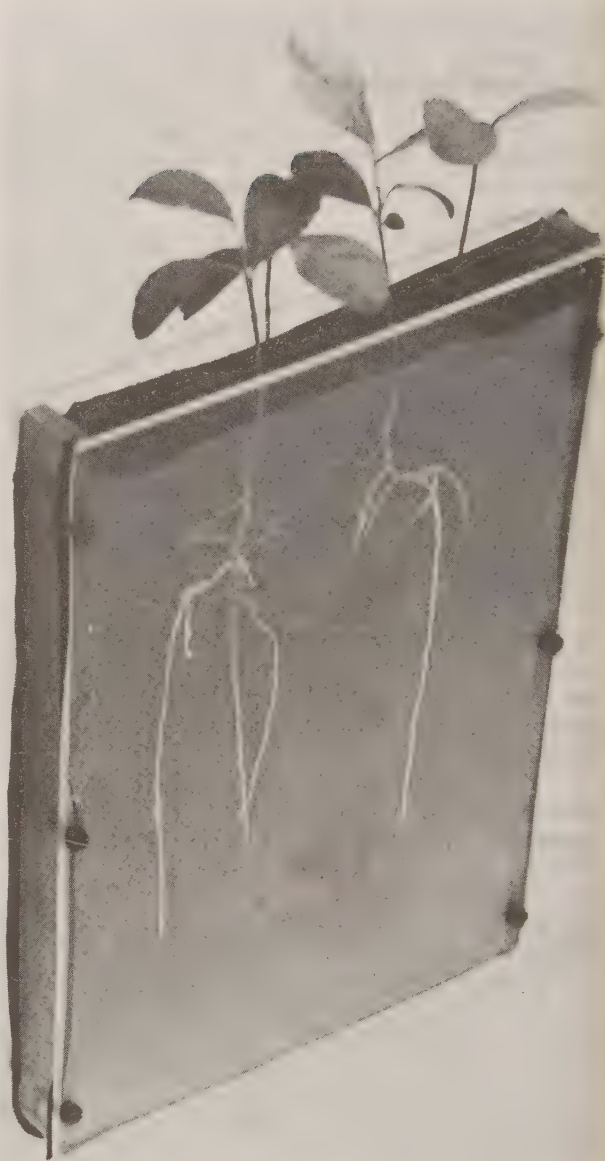
Research on citrus tristeza is also being conducted.

Citrus pests

Integrated control of citrus pests

There are now 300 000 citrus trees in the Rustenburg area under integrated control, without any preventive sprays for red scale. Triazophos was applied to 79% of the trees during the 1976/77 season, while tartar emetic plus sugar was applied to only 2% of the trees. The use of temephos (Abate 500E) to control thrips has been discontinued because of the repercussions which it caused, especially the increase of citrus red mite, *Panonychus citri*.

Ten different insecticides were tested in a screening experiment carried out in an orchard under integrated control, with red scale under biological control. Dimethoate (applied at the low dosage rate of 50 g/100l of water, as used previously in the Letaba-Letsitele area for thrips control) caused a serious increase in red scale which required a corrective spray. Acephate (Orthene) and dioxathion (Delnav) showed a tendency to increase red scale. A new carbamate (UC 51762) as well as



This miniature perspex root laboratory was specially designed to determine the reaction of citrus rootstocks in old and new soil

cyanofenphos (Surecide) caused a severe increase in citrus red mite. Carbaryl (Karbaspray) also tended to increase red mite.

An integrated control programme has been developed for Lowveld citrus orchards, allowing for a transition to a single spray for red scale every season, or even no sprays at all when the biological control of red scale is the objective, especially in the case of Valencias and Midseasons.

Abnormally heavy populations of resistant red scale were controlled in three orchards by making the maximum use of mineral oil, together with organophosphates, and by applying sprays early (commencing in July) so that parasites and predators were allowed to increase in the orchards.

The experiments indicated that early sprays (July/September) commencing in late winter were better than sprays applied from September (petal fall) to December. Recommendations were drawn

up accordingly for orchards where resistant red scale is a serious problem.

Citrus psylla

In an endeavour to find new ways of controlling citrus psylla, *Trioza erytreae*, which is the vector of citrus greening disease, systemic insecticides have been applied to the soil. In citrus nurseries, a single application of dimethoate to the soil was found to give eight weeks' protection of the seedling against psylla. At the same time citrus aphids were destroyed and citrus thrips were kept at low levels for six weeks.

On field trees, dimethoate was applied by microjet irrigation and also by drippers. In both cases, excellent psylla control was obtained for approximately seven weeks, in spite of heavy population pressure. Furthermore, aphids were reduced and red scale was significantly suppressed.

Nematodes

The nematicide trials in which phenamiphos was applied by microjet irrigation continue to give good results. Effective control of citrus nematode has now been obtained for at least 11 months, with a single application.

False Codling Moth

Experimental liberation of 55 000 moths sterilised by gamma irradiation was carried out in a Navel orchard in the Lowveld this year. These sterile individuals mate with the field population, leading to the production of sterile eggs. The experimental liberation resulted in a marked reduction in the losses caused by false codling moth, thereby proving the feasibility of this method.

The only disadvantage is the high costs involved in artificial rearing of the insect.

In a further attempt to find methods of controlling false codling moth a technique has been developed for mass-rearing an egg parasite, *Trichogrammatoidea luteum*, of the pest. The technique has proved highly successful and parasites have been successfully released in citrus areas where this pest has recently become a problem for the first time.

PINEAPPLES

Nematodes

Experimental work on the control of mainly *Meloidogyne javanica* and *Helicotylenchus dihystra* in Smooth Cayenne pineapples has been continued. The normal soil fumigants EDB, DD and DBCP are being compared with dipping of planting material and foliar spraying of systemic nematicides, namely, phenamiphos and oxamyl.

Nematode populations are also being monitored in a number of grass types, such as *Eragrostis curvula*, *Cenchrus ciliaris*, *Panicum antidotale*, *Fescue* spp., and *Chloris gayana*, and also two subtropical legumes, *Desmodium intortum* and *Phaseolus atrepurpureus*. This investigation is

being done to determine the most suitable ley crop for possible inclusion in a rotation with pineapples.

A survey of nematodes in the main pineapple growing areas of the Eastern Cape and the Hluhluwe and Levubu areas is also being carried out.

Herbicides

A large number of herbicides have been tested for the control of the grasses *Panicum* and *Paspalum* spp. Of all the herbicides tested bromacil continues to be one of the most effective for the control of weeds and grasses in pineapple fields. Mixtures of bromacil and diuron have also given excellent results.

The effectiveness of bromacil appears to be improved the sooner it is applied after planting. Many farmers are applying bromacil as a pre-plant application since this eliminates the difficulty often experienced when heavy rains and continual strong winds make application at the desired time impossible. A sealer application generally follows after planting.

Soils in the Eastern Cape having a high clay content (approximately 40%) and high organic content remain a source of great concern, since it is in these soils that very poor weed and grass control is obtained.

Growth regulators

The use of a follow-up application of the flower inductant alpha-naphthalene acetic acid (ANA) 10 days after the initial use of one of the following commercially used flower inductants for pineapples, namely, beta-hydroxyethylhydrazine (BOH), 2-chloroethylphosphonic acid (ECP) and alpha-naphthalene acetic acid (ANA), was investigated.

Results have shown that where ANA, which is the most popular flower inductant used by growers, is used for the initial application, it is essential to follow up with the second application to ensure an acceptably high percentage of flower induced plants. This is particularly necessary during the warm summer months on young plants, which will bear a spring plant crop. In certain cases the percentage take was increased from 30% where one dose of ANA was applied, to 92% where two were applied.

Where BOH or ECP has been used, the second application is not as essential because the percentage take is generally better. But this practice of a second application is still advised, because-

- (a) it is cheap to apply at approximately R2,00 per ha for the material;
- (b) it ensures an acceptable percentage take, which facilitates more economic use of land and labour.

Pineapple propagation

A number of trials conducted on Smooth Cayenne pineapples in which chlorflurenol was tested, proved that this chemical, when applied at



The advantage of applying ANA twice to pineapple plants is clearly visible in the rows on the left. The remedy was only applied once to the rows on the right and a large number of the plants did not form fruit

the correct time and quantity, could assist in the reproduction of planting material.

Plants treated with chlorflurenol, one week after artificially inducing flowering with ethephon, produced fruit bearing up to 35 fruitlet slips. The fruitlet slips of 5 cm in length derived from this treatment when planted out under field conditions only had a 40% mortality. Hardly any losses were recorded where fruitlet slips exceeded 10 cm in length.

This method of rapid reproduction has the following advantages over former methods:

- (a) It is easy to apply, thereby saving on the labour and time-consuming method of sectioning plants.
- (b) The plants can be planted direct into the land, whereas plant sections usually have to be placed in special beds prior to planting out.
- (c) A relatively low mortality takes place in the fruitlet slips, whereas large numbers of sectioned plants often die as a result of fungal infection.
- (d) Far less capital outlay is involved, thanks to the simplicity of this method.
- (e) The fruitlet slips bear fruit far more quickly than those obtained by sectioning.

Fertilisation

Work has been continued with the potassium requirement of pineapples. Results have shown that

where a soil analysis of under 100 ppm K is diagnosed, in heavy soils, approximately 200 kg of K is required per hectare for the plant crop to give optimum results, whereas in sandy soils in the vicinity of 300 kg of K is required per ha.

Experiments have also been carried out to determine the most suitable form and quantity of iron to apply. Indications at present are that iron sulphate is the most suitable form. Applied at a rate of between 50 and 75 kg/ha for the plant crop it will give the most beneficial results where deficiency exists.

Plant selection

Preliminary results have shown that plants selected for fruit shape have produced a far higher percentage of desirably shaped fruit over field-run plants obtained from commercial growers. The incidence of undesirable characteristics such as multiple tops was also much lower among the selected plants.

Pests

White grub

The screening of 10 insecticides for the control of white grub and black maize beetle is in progress at the East London Agricultural Research

Station. This pest has become a severe problem on certain large farms in the Eastern Cape during the past year.

At present it appears that a pre-plant soil treatment of HHDN is still the most effective control method.

Mealybug

A number of trials are being carried out at East London and Hluhluwe to obtain a quantitative estimate of the effect of mealybug infestations on fruit yield and also to determine the efficacy of different rates of HHDN on ant control and the incidence of mealybug.

Results obtained to date have shown that even light infestations of mealybug can significantly affect fruit yield.

BANANAS

Cultural aspects

As a result of a rather low production of bananas and improved ripening and distribution facilities by the Banana Control Board during the past season a very good price was realised for the producer. This has caused an increase in interest in banana growing and will probably result in bigger areas being planted to bananas in the near future.

The first results of a commercial planting of Williams became available and indicate that it is superior to Dwarf Cavendish, producing heavier bunches with larger fruit. Williams is also free of choke throat during winter, which was one of the major problems of Dwarf Cavendish.

The Americani banana imported from Reunion is still in quarantine.

Banana pests

Over the past year, special attention was given to pests causing marking of banana fruit. It has been found that the thrips, *Hercinothrips bicinctus*, and the cotton mite, *Tetranychus lombardini*, are the major problem in the Transvaal banana areas.

In addition, grey mite, flat mite *Brevipalpus obovatus* and another thrip, *Frankliniella* sp. are sporadic pests in all areas. Chemical control trials have demonstrated that sulphur dusting, if correctly done, will control these pests. Experiments with triazophos have also shown promise against thrips, whereas chlorobenzilate and dicofol appear to be effective against the cotton mite. Trials will continue during the coming season.

Post-harvesting treatment

Several aspects of the post-harvesting treatment of bananas were investigated during the past season. With a view to the export situations, trials were carried out to determine after how long a storage period the fruit can still be successfully ripened.

It was found that bananas can still be successfully ripened after a storage period of up to five weeks. The fruit should, however, be extremely

carefully handled right from harvesting because the slightest mechanical damage will develop into a prominent black lesion during the long period of storage. Collar rot is also very severe in this fruit. Although the fruit is still able to colour well after a longer storage period, it then tastes old and shows an unacceptably high incidence of collar rot.

Thiabendazole and benomyl, at the recommended concentration of 50 ml (g) of the product per 100 l of water, were found to be equally effective in controlling collar rot. Higher concentrations of the fungicides have little advantage, and lower concentrations are ineffective. Despite great variations in the results of these trials, it appears that the consumption of fungicide from the immersion tank is between 5 and 15 ml (g) to every 1 000 kg of fruit dipped. When the suspension in the immersion tank is not continuously stirred or circulated, the preparation precipitates and the concentration in the immersion tank changes from 50 ml (g) per 100 l of water to 56 ml (g) per 100 l of water in as little as an hour.

The trials also showed that the fruit loses 3,3 per cent of its weight during transportation to Cape Town, and an additional 5,3 per cent during ripening - a total loss of weight of 8,6 per cent from the packer in the production area to the dealer in Cape Town.

Phosphonic acid can be effectively used for ripening bananas. The fruit is immersed in a solution of phosphonic acid (500 ppm active ingredient). The fruit is then packed in cases and left outside to ripen. Spraying the fruit with solutions of up to 2 000 ppm is not as successful.

Research on Panama disease in bananas is still in progress.

AVOCADOS

Cultural aspects

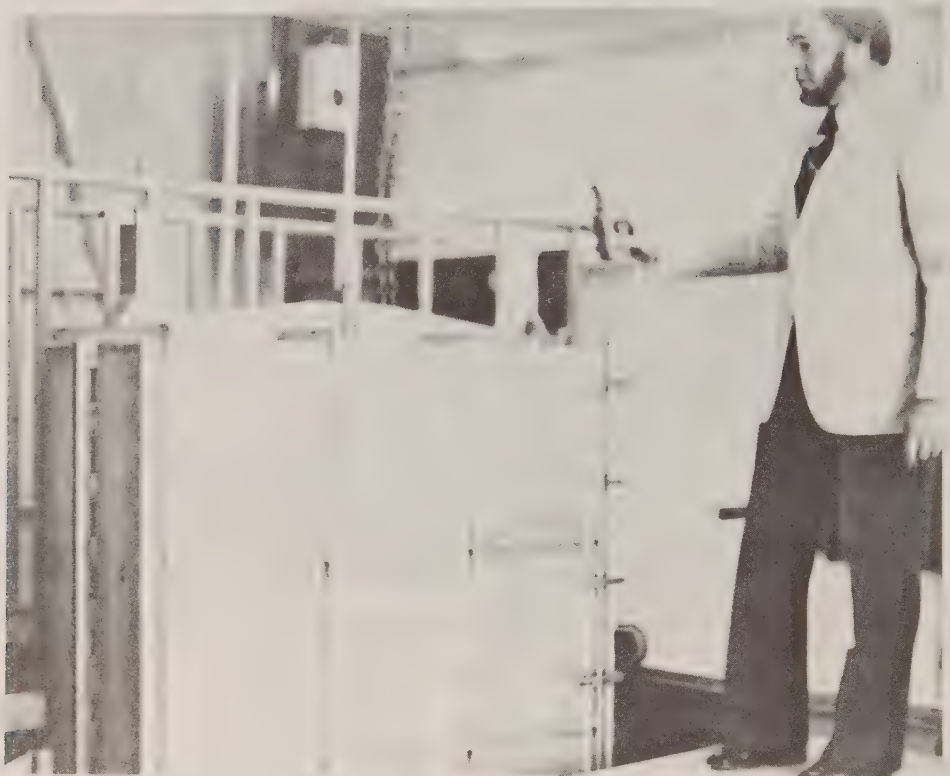
The new cultivars Duke 7, Duke 6 and G22 were planted as rootstocks and Bacon, Teaque, 011 Boyee, Topa-Topa and Ettinger were planted as scions at Burgershall and Levubu. The object was to carry out adaptability studies and provide plant material for the avocado industry.

Preliminary observations show that the cultivars Zutano and Ettinger do not meet the quality requirements. Studies on graft compatibility are continuing with several Duke rootstock selections in various avocado production areas. These studies show that the cultivar Zutano is the most promising rootstock in respect of graft compatibility, although its resistance to *Phytophthora cinnamomi* has not yet been established.

Diseases

Several nurseries are interested in applying techniques for the production of trees that will be free of *Phytophthora* root rot. Trials with a variety of chemicals, carried out both on infected trees and *in vitro*, are showing promising results.

The first mycorrhizal fungus was found on avocado roots and identified as *Glomus fasciculatus*.



This irradiation unit is used for the control of the mango seed-weevil. The unit is the result of research done by the Citrus and Subtropical Fruit Research Institute in conjunction with the Atomic Energy Board and an agricultural co-operative

Post-harvesting treatment

A number of problems are still being experienced with the quality of export avocados in particular. An investigation was therefore undertaken during the year under review into the effect of calcium and ascorbic acid infiltration, potassium permanganate as an ethylene absorber, partial ripening of the fruit before storage, the storage of avocados together with apples, and the storage of fruit packed with long stems, in comparison with the ordinary short stem pack. The low temperature tolerance of Fuerte avocados was also studied.

It was found that calcium and ascorbic acid tree spraying had no effect on the keeping quality of the fruit, but infiltration of these preparations

into the fruit was too drastic. Ripening of the fruit was retarded to such an extent that there was spoilage before normal ripening could take place. As a result the incidence of anthracnose spoilage, stem-end rot, lead discolouration and internal browning was very high. A slight decrease in vascular bundle browning and pulp spot was observed, however.

Potassium permanganate as an ethylene absorber was very disappointing in these trials. There were, however, positive results in that anthracnose spoilage, vascular bundle browning, lead discolouration and stem-end rot were slightly reduced by packing with this absorber. The differences were very slight because avocados do not produce much ethylene and this gas is therefore not very important unless avocados are stored together with other products.

The partial ripening of avocados has advantages because partially ripened fruit is far more resistant to cold. However, in the course of these trials the fruit showed abnormally severe lead discolouration. A further practical problem attached to this method is that the ripe fruit bruises very easily during normal handling.

Avocados should never be stored together with fruit such as apples. This trial showed that avocados stored with apples showed far more anthracnose spoilage, stem-end rot and internal browning than fruit stored on its own. Vascular bundle browning, lead discolouration and pulp spot were also far more severe in this fruit, although this was not as marked.

It would appear that the inhibitor that prevents an avocado from ripening on the tree can be used to some extent after harvesting by packing the fruit with long stems (200 mm). Although such fruit does not really take longer to ripen, it does appear to have a longer shelf life after ripening than fruit harvested with short stems. It has been found that when the packed fruit is handled it is very difficult to retain the long stems, which break off very easily.

The low temperature tolerance trial again showed that Fuerte avocados are extremely sensitive to temperatures below 5 °C. It has also been found that cold damage very soon occurs if the storage temperature is reduced to below the recommended 5,5 °C. If the fruit is exposed to a temperature of 0 °C for a mere 6 hours severe cold damage develops. However, the symptoms are not immediately visible and occur only after a further storage period of a week or more.

MANGOES

Cultivation

In 1980 there are expected to be about a million mango trees in production - an increase of 500 per cent over the past decade.

Owing to their resistance to mango bacterial spot (pathogen *Pseudomonas mangiferae indiciae*), the fibrous cultivar Peach and the fibreless cultivars Zill, Fascell and Sensation are recommended for commercial planting. Of the recently released cultivars Nimrod, Tommy Atkins and Florigon Early Solid, the last two appear promising. Imported cultivars not yet released include Gouveia, Adams, Ruby, Julie, Pope and Momi-K.

The selection programme was put back by about three years as a result of a devastating hailstorm during November 1976.

Pruning trials showed that the potential yield per tree can be boosted by 20 per cent if mango trees that are too densely spaced are exposed to more light and air. By pruning alternate trees in densely planted orchards severely, it was possible to boost the marketing potential of the orchards by 20 per cent, although when a 30 per cent crop loss as a result of factors outside the producer's control was taken into account it was found that only half the orchards was in production. Selective pruning where the trees were pruned back over a period of

five years does not appear to be promising. The hedge pruning method is being investigated.

A biochemical investigation into fruit drop showed an increase in the peroxidation enzyme activity which is probably stimulated by ethylene. The early treatment of flowers and fruit against the formation of ethylene is now being investigated.

Pests

Mango weevil

Results of several years of research reached a climax this year. Trials on a late-maturing cultivar (Kent) once again showed that irradiation at 50 krad was effective in preventing emergence of the weevil from the seed. This led to the development of a pilot commercial plant for the irradiation of mangoes. The plant was erected by a farmers' co-operative in the Northern Transvaal, in conjunction with the Atomic Energy Board, and is the first plant of its kind for the irradiation of subtropical fruit.

Post-harvesting treatment

In several trials undertaken during the past season irradiation and fungicides were used to control post-harvest spoilage in mangoes. The temperature requirements for mangoes shipped overseas were re-examined.

The results showed that irradiation, storage temperature and the fungicides applied had a considerable effect on colouring and spoilage in mangoes shipped overseas. However, as soon as the fruit was removed from the hold upon arrival overseas the colour differences caused by the different treatments were less noticeable. Irradiated fruit does not colour as it should at a storage temperature of under 13 °C. However, irradiation provides additional control of anthracnose rot, over and above the control obtained from a hot fungicide treatment.

It appears that good quality mangoes can be very successfully exported by sea provided they are treated against post-harvest spoilage with a hot fungicide immediately after harvesting and stored at a temperature of 10 °C during transportation. Their shelf life can be prolonged if they are irradiated at a dosage of 75 krads after the above-mentioned fungicide treatment. In this case they should be stored at a temperature of 13 °C because the irradiation retards the colouring of the mangoes slightly. The higher temperature will compensate for this.

LITCHIS

Cultivation

Selection is still being carried out to obtain fruit that ripens earlier or later than the present commercial varieties. Promising selections have already been found and are being multiplied for further testing at various experimental farms.

Fertilising

Results obtained over the past few years in a fertilising trial with litchis provided conclusive evidence of the importance of nitrogen fertilising for this crop. When the nitrogen dressing was increased from 0,4 kg of limestone ammonium nitrate to 1,6 kg per tree production was over six times as high. The fruit was also 35% larger and had a higher sugar and lower acid content. Despite the fact that the phosphorus and potassium reserves of the soil in the trial were very low, very little response was obtained from the application of these two elements.

Litchis exported by sea are stored at a temperature of 0 °C. The fruit does not easily spoil at this temperature. However, when the fruit is removed from the cold stores overseas fungal growth appears very rapidly and the fruit may be completely unusable within a day or two. Post-harvesting fungicide treatments were therefore tested again during the past season in an attempt to control this fungal growth. The effect of a hot water treatment, several types of fungicides and combinations of fungicides applied hot or cold and the effect of packing in cellophane as against the standard open pack were investigated.

The trials showed that hot mixtures of various fungicides can reduce fungal growth on the fruit from 80% in the control to a mere 7 per cent. A clean hot water treatment (at 52 °C for 10 minutes) was not quite as successful. The fruit that received this treatment showed 44% spoilage. The fruit treated with the hot fungicide combinations kept very well for three to four days after removal from the cold store, after which it also began to spoil rapidly and develop an unpleasant taste. Packing in cellophane was very harmful because the moister conditions caused the fruit to develop more serious fungal growth, more rapidly, in all cases. The drier the fruit is kept, the less the chances of fungal growth.

PAWPAWS

Cultivation

Pawpaw research suffered a serious setback as a result of a hailstorm at the Institute in November 1976. Promising crossings and selections were destroyed. Open-pollinated seed was collected from the trees and although it is not true-to-type, it will be used to continue pawpaw research.

Post-harvesting treatment

Pawpaws respond well to a post-harvesting immersion treatment in a hot fungicide. The temperature/time combination of the immersion treatment is critical, however. Because of the great variations obtained in such trials, the matter was investigated again during the past season. Because the results vary so much a large number of trials had necessarily to be carried out. It was found that where a short immersion period (about 5 minutes) was used a temperature of 52 °C provided the best control of post-harvesting spoilage.

Longer immersion times required lower temperatures because the skin of the fruit can easily be damaged by this treatment. Too short an immersion period was not effective in controlling post-harvesting spoilage in pawpaws. The final recommendation is that the fruit should be immersed, immediately after harvesting, at a temperature of 50 °C to 52 °C for a period of 10 minutes.

GRANADILLAS

The area under granadillas shrank even further during the past season. As a result of another wet summer season the incidence of disease was high.

To date there are still no reliable measures for combating the diseases which are causing granadilla decline. Foliar fungal diseases, *Phytophthora* stem rot and virus diseases are the major causes of the short lifespan of granadilla plants.

The latest research has shown that by grafting the purple granadilla, *Passiflora edulis*, onto the yellow species, *P. edulis forma flavicarpa*, the stem rot problem was almost eliminated, provided grafting was done at least 300 mm above ground level.

Another batch of selected hybrid seed has been imported from Australia in the hope of finding a good hybrid.

GUAVAS

About 15 000 tons of guavas is produced annually, of which only about 5 000 tons is marketed as fresh fruit. The major portion of the crop is used for canning and processing into juice. The manufacture of guava rolls is expected to increase considerably in future. The demand for guava juice has also increased. Many new plantings have therefore been established.

A planting of 1 500 seedlings was established with a view to the selection of promising types and the standardisation of new cultivars. Several cultivars were imported from abroad, including Pink Indian, Puerto Rico, WK 11-26, Kahua-kula, Beaumont and Red x Supreme Ruby. These cultivars are still in quarantine.

A trial was also started to determine the correct methods of pruning and spacing guavas under local conditions.

PECAN NUTS

Cultivation

According to the latest survey 143 000 pecan trees have been planted in commercial orchards. 61 000 trees are in production. It is calculated that 50 000 trees will be planted in the foreseeable future.

Nuts to the value of over R3 million are imported annually and there is every prospect of a good local market for locally produced nuts.

Various cultivars are being tested in order to determine which does best in South Africa. The cultivars *Barton*, *Choctaw* and *Desirable* are ideal

Pecan leaves that turned black as a result of sooty-mould growth on the honeydew secreted by aphids. (Compare the clean leaf.) Research shows that this pest can easily be controlled with sprays



for planting in the Lowveld areas and Natal. In areas where scab is not a problem, *Wichita* can also be planted. The cultivar *Moore* produces a good crop, but the size of the nuts and the kernel percentage are below optimum. The cultivar can, however, be recommended with certain reservations. A new cultivar, *Cheyenne*, appears very promising and is at present enjoying special attention to determine whether it should be added to the list of recommended cultivars.

Fertilising

In a pecan fertilising trial conducted over a period of three years it was found that the optimum production of nuts depends mainly on nitrogen and, to a lesser extent, phosphate fertilising. Nitrogen dressings boosted the yield by up to 42%, and in the case of phosphate dressings the increase was 27%.

Pests

Aphids

A new pecan pest, the pecan aphid *Monellia nigropunctata* (Granovsky), was found on pecan trees for the first time in the Transvaal Lowveld. This aphid is a well-known pest of pecan trees in the USA. It is not known when and how the pest entered South Africa. The aphids cause no direct damage, but owing to their capacity for secreting large quantities of honeydew on which a sooty mould grows, the leaves turn black. This makes the leaves less permeable to air, which has an adverse effect on photosynthesis and consequently also the crop.

A spraying trial with three insecticides and an ant barrier showed that pirimicarb 49,25% WP at 100 g/100 l is sufficient to suppress aphids for a period of nine weeks to such an extent that only minimal sooty mould formation occurred on the leaves. The population increase of the aphids after this nine-week period was less important, since that

was the start of winter conditions, with natural leaf drop.

It was also evident that spraying in the middle of January is suitable. Pirimicarb appears to be a very safe preparation in respect of predators since predatory activities were evident two weeks after spraying. The preparation has, however, not yet been registered for use.

MACADAMIA NUTS

The production of macadamia nuts in South Africa is increasing rapidly and the commercial processing of nuts is being investigated.

Cultivar studies are of the utmost importance at this stage so that the correct cultivars for various areas and the most acceptable cultivars for processing can be identified.

The cultivar Nelmak 2 still produces the highest yields. Of the imported cultivars the Hawaiian cultivar Keaau performed best at Nelspruit, and the cultivars Ikaika and Keaauhou produced the biggest crop at Levubu.

TEA

The 22 selections made from a planting of 879 912 seedlings are growing well.

A trial planting of 1 ha tea plants was established; half are seedlings and the other half clone material from the clone MT 12.

COFFEE

Cultivation

The higher coffee price has given rise to unprecedented interest in coffee growing in South Africa. The current production of about 200 tons is still far below the annual consumption of 18 000 tons.

The cultivars SL 14, SL 28 and SL 34 (in this order) produced the best yields and are recommended for commercial planting.

A new planting was established at the Burgershall experimental farm in order to determine the yield potential in an area that is pre-eminently suited to coffee growing in South Africa.

Fertilising

The results of a fertilising trial conducted with coffee over the past four seasons show that this crop does not respond to phosphorus and potassium fertilising if reasonable reserves of these elements are present in the soil. However, nitrogen fertilising is of the utmost importance to high production. The average production over the four seasons was 725 kg/ha of dry coffee where no nitrogen was applied, as against 1 300 kg when 500 g of limestone ammonium nitrate LAN (30%) per tree was applied annually. One year the yield was 1 300 kg with no nitrogen fertilising and 3 100 kg of dry coffee per ha with the application of 500 g of LAN per tree. The results of leaf analyses of commercial plantings confirm this finding in that it was found that the nitrogen requirements of an

adult coffee tree are 400 to 500 g of LAN annually. The phosphorus and potassium requirements are determined by the reserves of these elements in the soil.

PEPPER

The experimental pepper planting at Burgershall produced an average yield of 360 g of processed (black/white) pepper per plant. A plant population of 2 500 per ha may be regarded as the minimum density.

SPICES

Interest in spices increased in the Lowveld over the past year.

Observations with regard to the yield, resistance to disease, germination percentage of the seed and general growth habit of the bixa plant were carried out and the information obtained indicates that bixa could become a commercial crop. Several trials are still in progress and will provide answers to questions on the harvesting stage, espacement and pruning.

Trials with coriander were carried out at the Institute in order to determine the best planting time. Further trials were carried out to establish how the growth rate and yield differ in plants planted during autumn and those planted in spring.

Thirty different varieties of spice seed were imported from Rhodesia, and a number of plants were established at Burgershall and at the Institute. The adaptability of these plants is being investigated.

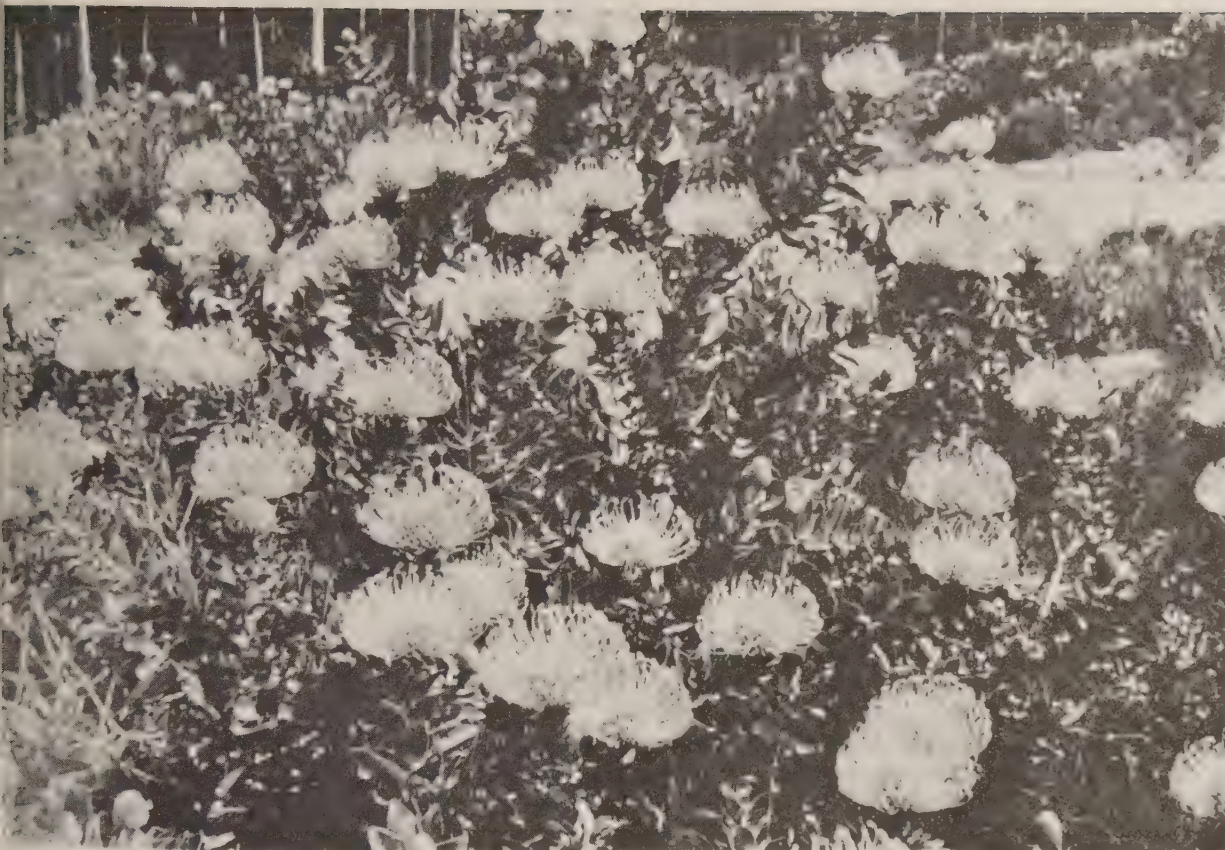
GINGER

For the third successive year half a hectare of ginger, consisting of a large number of agrotypes, was planted at Burgershall. Two promising strains which meet the quality requirements have been selected so far. Further selection and multiplication are continuing.

FLOWERS AND ORNAMENTALS

The production of chrysanthemum cuttings for export is an important branch of the flower industry, and one which has been established for several years, although it started in a small way. There are a small number of established firms in Europe that breed new chrysanthemums and also go in for multiplying propagating material of all the chrysanthemum cultivars for the cut flower industry. The material is multiplied almost exclusively in glasshouses and consists of high quality hybrids, purified of noxious viruses and other pathogens (disease-free indexed material).

In the course of time these European firms have found that, because of the more favourable growing conditions, especially with regard to temperature, it pays them to have the multiplication done in South Africa. The disease-free indexed basic material is sent by air to



The pin-cushion *Leucospermum cordifolium* forms a large part of South Africa's protea exports

South Africa, where it is multiplied for one generation. The multiplied unrooted cuttings are then re-exported in bulk, by air to the parent companies.

Owing to the phenomenal rise in the cost of fuel for heating glasshouses in Europe, multiplication in South Africa has become far more advantageous and this is being reflected in higher exports.

A few years ago not much more than 5 million chrysanthemum cuttings a year were exported and only one of the big European firms was involved. Now other firms have entered the market as well and even invested a considerable amount of capital in the local industry, with the result that by the 1976/77 season exports amounted to 32 million chrysanthemum cuttings. The intention is to increase these exports considerably in the near future.

This development is considered a very important contribution to the expansion of the flower industry in South Africa, especially with regard to its potential as an earner of foreign exchange.

PROTEAS

The overseas price of the most important export protea, the pincushion *Leucospermum cordifolium*, dropped unexpectedly in October 1976. This was the first time that there has been an

overproduction of this cut flower. However, there was still a keen demand for *L. cordifolium* cut flowers delivered after October, and for types with larger flowers.

Ornamental foliage, used to supplement the cut flowers, made up about half the total quantity of export flowers. The foliage consisted mainly of veld-harvested tolbos proteas (*Leucadendron* species) and ericas.

The demand for propagating material of protea varieties that flower in summer increased sharply over the past season. Producers preferred to cultivate particular species variants with a better cut flower potential, and individual selections that are propagated by vegetative means rather than the unselected species that used to be grown. Over the past few years the production of proteas for the cut flower market has become increasingly intensive.

As a result of Departmental research a technique was developed last season for breaking dormancy in most of the *Leucospermum* species, such as *L. cordifolium*. The technique consists of acid scarification of the seed, followed by imbibition in hydrogen peroxide.

There has been progress with research on the chemical manipulation of the flowering time of *L. cordifolium*. The growth regulant ethephon will undergo final testing during the coming season. Its efficacy in postponing the flowering time of *L. cordifolium* from spring to early summer will be determined. This development is considered especially important for the export industry.

About 200 protea species and variants, including about thirty Australian species, are being grown at the Tygerhoek experimental farm for protea research at Riviersonderend. Approximately 400 vegetative and seed selections of those cut flower species that are of economic importance are also being evaluated. During the coming season more emphasis will be placed on the problem of *Phytophthora* rootrot of proteas, and to the breeding of summer protea cultivars.

A new pamphlet series is being compiled as part of the extension service to the industry and will be distributed throughout the country shortly.

BREEDING OF INDIGENOUS FLOWERING BULBS

Lachenalias

This South African bulb variety has a great commercial potential as a pot plant, garden plant and cut flower. Over the past four years almost all the pure species, and a large number of subspecies and ecotypes, have been collected. During this period 279 different crossing combinations have been made from these pure species. Since proteas only flower after 3 years, only some of the combinations have flowered as yet. Those combinations that have already flowered have been used to make a number of selections which are great improvements on the present commercial types. These selections are undergoing further testing and multiplication for possible release to the industry. The only selections that are widely grown in the industry at present have yellow flowers tinged with red. Although the breeding programme is producing many promising yellow selections, the red and blue types are really the most promising and would meet a need in the industry.

Ornithogalum

The *Ornithogalum* is already a popular garden plant and cut flower on both local and overseas markets. The variety is exported chiefly in December. However, there is still a great deal of room for improvement.

The breeding programme at the Horticultural Research Institute is aimed at producing a longer inflorescence, increasing the number of flowers, improving the keeping quality and introducing colours such as yellow and orange among the commercial types. The collection of pure species is still being expanded in order to enlarge the gene pool. Crossings the Institute received from a breeding programme at the University of Stellenbosch are being evaluated and the first crossing made at the Institute will flower in 1977.

Gladioli

This breeding programme is in its initial stages. At the moment *Gladiolus* varieties - chiefly pure species - are being collected and evaluated for

resistance to disease. Species that show resistance to particular diseases will be used with cultivars to transmit the resistance to the commercial types.

Propagating studies with bulb varieties

Because some promising *Lachenalia* breeding strains multiply very slowly by means of bulbs, an attempt has been made to multiply them on a large scale by means of tissue culture methods. Tests have shown that large-scale multiplication of the plant using pieces of leaves, flower stalks or bulb scales is possible in certain media. This means that it is now possible to multiply such breeding strains rapidly so that they can be tested commercially before being released as new cultivars.

The same techniques have been used to multiply the dahlia bulbs of certain cultivars. In this case, however, parts of the growing points were used. It is therefore now possible to obtain a quick multiplication from these virus-purified cultivars.

POT PLANTS

Hypoestes aristata

This South African plant continues to show considerable promise for production as a commercial flowering pot plant.

Further work has been done on the reaction of various selections of differing colours to temperature and day length. It has been shown that considerable variation exists especially in response to photoperiod.

Selections which have convenient response times for year-round production are therefore being selected and good progress in this respect has been made.

Bougainvilleas

Bougainvilleas have been shown to have certain desirable characteristics for production as pot plants. Thus plants of different sizes can readily be produced to provide decorative plants for various situations in flats, houses, hotels or large office buildings.

There is also the fact that unsold plants may be pruned back after flowering and re-flowered within two months, provided day temperatures of at least 24°C and night temperatures of not less than 12°C can be provided in a well-lit glasshouse. This potential of rapid re-flowering enables accurate timing for particular market needs to be achieved and also avoids wastage of unmarketed material.

Diseases of flowering plants

Hippeastrum

Two viruses have now been identified from material obtained from certain growers, viz *Hippeastrum* mosaic and *Hippeastrum* latent virus.

Gerbera

The disease that causes abnormal growth in flowers has been successfully transmitted to

seedlings of this plant by means of flower budding. Since it is suspected that the pathogenic organism is a mycoplasma, flower budding is followed by transmission by means of dodder and budding to *Vinca rosea*.

***Verticillium* wilt in roses**

The rootstock Basye 3, which previously proved resistant to *Verticillium dahliae*, has been evaluated on a larger scale. Although no symptoms of *Verticillium* wilt occurred in infected plants, the pathogen was isolated in 33% of the plants from the first lateral branch. This confirms the theory that this rootstock is tolerant rather than resistant. The resistance found in less popular rootstocks will be more extensively investigated in future.

VEGETABLES

TOMATOES

Fresh market tomatoes (cultivars and breeding)

Good cultivars such as Heinz 1370, Manapal, Mooketsi and Karino are adapted throughout the country and are available to the industry. However, neither any of these nor any other good cultivar is resistant to bacterial canker, spotted wilt or bacterial wilt. There are no effective control measures against these three diseases, so the chief aim of breeding at Roodeplaat, Elsenburg and Nelspruit is to produce resistance to these diseases. Progress has already been made in all three cases and promising selections have been obtained from the crossings. The breeding parent H2990 was used against canker and Rey de los Temporanos against spotted wilt.

Evaluation of the best local and overseas cultivars is being continued on a national scale. It is evident from the results of the past year that Heinz 1370 is still the best cultivar in all areas. Walter is well-adapted in the Western Cape, Karino and Letaba in the Lowveld, Karino and Selection 1366-1-1 in the Free State and Floradale and Velox in the Middleveld and Lowveld of the Transvaal.

Cultural studies

Studies on establishing tomatoes by direct sowing were again undertaken. The spraying of plant rows with polyalkyl amide (PAM) prevented the soil from becoming compacted and speeded up emergence. The use of this preparation involves practical problems with regard to the pH, which is critical, and the risk that rain or irrigation within two hours of spraying could reduce the efficiency. Spraying the plant rows with phosphoric acid has the same conditioning effect. The effect only lasts for about 14 days, but this is long enough for germination. The spraying mixture consists of 20% phosphoric acid and water and is applied at a dosage of 0,4 litres per square metre.

The study of alternative systems for training tomatoes was repeated. The results confirmed

previous findings, viz that market tomatoes can be grown without training by -

- (a) using banks to ensure good drainage;
- (b) using cultivars with a determinate growth habit, such as Heinz 1370, which can be accommodated entirely on bank; and
- (c) using fairly sturdy cultivars with fruit that remains on the vine for a long period.

Protected cultivation

Research was aimed at evaluating cultivars and finding suitable planting times so that growth and fruit setting in particular during the unfavourable winter months can be avoided. Three plantings were established in both the fibreglass and plastic greenhouses. These houses are mechanically ventilated and are not heated.

The first planting date was 28 January; the first ripe fruit from these plants was harvested on 4 May, 96 days after planting, and the plants continued bearing for 118 days, up to 30 August. This means that it was possible to harvest throughout the winter months.

The following planting was established on 25 February. In the plastic greenhouse the crop was harvested from 18 June, 113 days after planting, and in the fibreglass greenhouse harvesting started 127 days after planting; harvesting therefore continued for 180 days, up to 22 December.

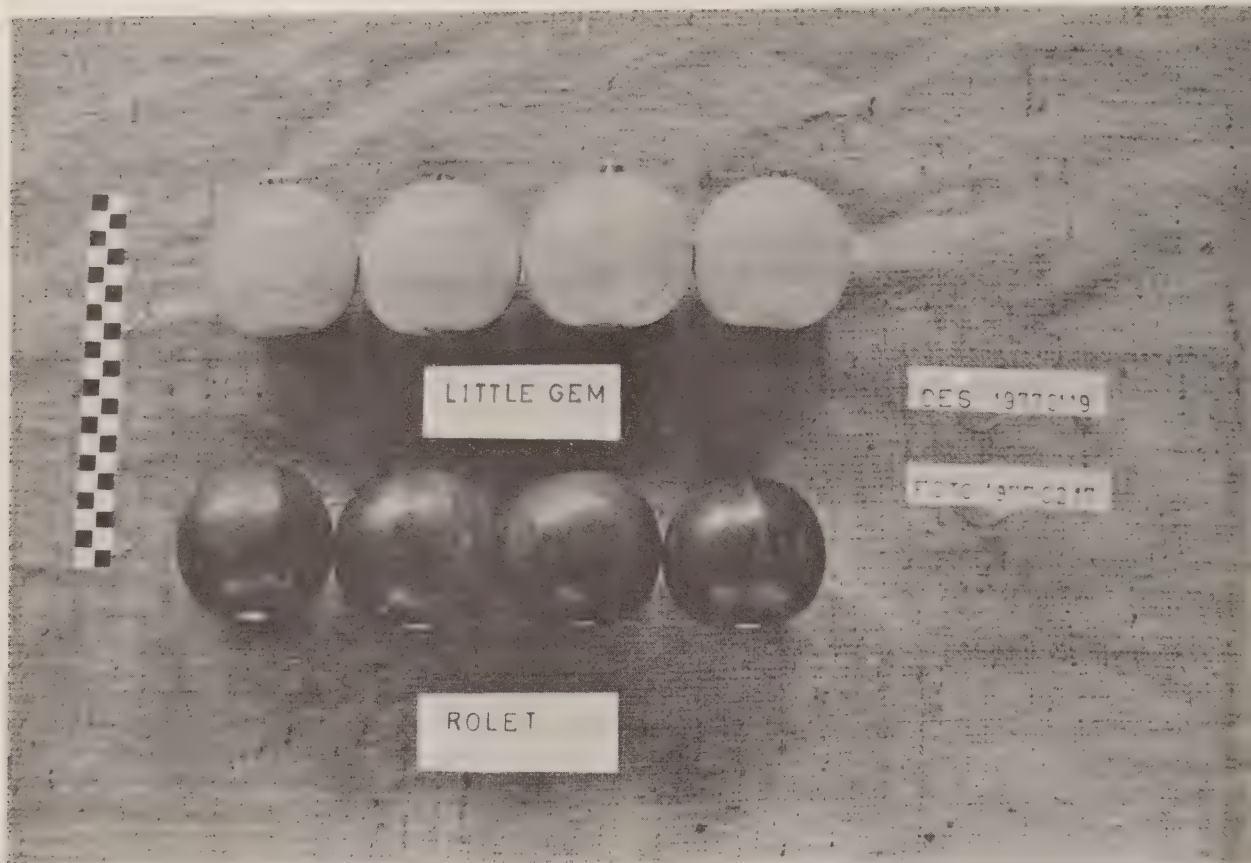
The pattern in respect of hollow fruit, small fruit and marketable fruit (diameter over 35 mm) was the same throughout in both greenhouses. For planting date 1 the average percentage of hollow fruit for 13 cultivars was about 20% under both fibreglass and plastic, calculated on the basis of numbers.

With planting date 2 there was 28% hollow fruit under fibreglass and 21% under plastic. The reason for the high percentage of hollow fruit was that the houses became too cold during the winter. Consequently fertilisation and fruit development did not follow the normal course and the fruit set without pips and jelly around the pips.

Besides the excessively low winter temperature, there was a technical reason for the high percentage of hollow fruit in the fibreglass greenhouse, namely problems with inadequate light in the greenhouse, leakages of warm air etc. It was therefore decided to replace the fibreglass plates of the greenhouse with others that have a greater translucency and to modify the construction to make it more air-tight.

The results therefore show that in conditions such as those experienced at Roodeplaat planting times for autumn and winter production should be so chosen that the adverse effect of low temperatures on fruit setting and development can be eliminated. In similar climatic conditions early planting in January can produce a satisfactory crop from May to the beginning of September.

At Elsenburg it was established that all the imported cultivars tested there under cover are very sensitive to the spotted wilt virus. Breeding and selection against this disease are being undertaken in the area.



The difference in keeping quality between Rolet, a new gem squash bred by the Horticultural Research Institute, and the standard cultivar Little Gem

Tomato diseases

- (a) Several breeding strains were imported as part of the tomato breeding programme and the number of locally produced breeding strains was increased. This is probably related to the appearance of a new type of anthracnose which occurred fairly widely on ripe canning tomatoes. The pathogenic fungus was identified as a *Colletotrichum acutatum*. In former years anthracnose occasionally occurred on ripe fruit and was ascribed to *C. phomoides*.
- (b) The craze for growing tomatoes in plastic tunnels is due partly to the assumption that few or no leaf diseases occur in tunnels. During the past season, however, early blight *Alternaria solani*, late blight *Phytophthora infestans* and bacterial spot *Xanthomonas vesicatoria* were observed on tomatoes under plastic and in some cases the fruit was affected by *Botrytis* spp. Tomatoes in plastic tunnels therefore require thorough spraying.

Verticillium wilt in tomatoes

The degree to which an individual plant is affected by *Verticillium* wilt is difficult to measure. Consequently it was decided to use the average number of infections per plant that result in wilting of the plant as the criterion for measuring the response of infected plants.

Tomato canker *Corynebacterium michiganense*

The method developed for testing tomato cultivars and strains for resistance to canker again yielded very satisfactory results.

It was confirmed that H2990, P4023, Okitsu Sozai No. 1, L1051-1-2 and, to a lesser extent, P4024 are considerably more resistant to canker than Roma VF, which was used as a standard susceptible cultivar. Crossings between H2990 and Florida MH-1 also appeared promising.

On the other hand the trials showed Rossol and Manapal AA to be very susceptible to tomato canker.

Viruses

A number of virus-infected tomato plants were found in plantings in protected structures. The commonest virus was tobacco mosaic. Mutated races of the virus were obtained with a view to preventive immunisation tests on the tomato plants.

PUMPKINS

No serious production problems were experienced with pumpkins during the past year. Powdery mildew *Sphaerotheca fuliginea* and pumpkin fly were the chief causes of reduced yields. Greater uniformity and better quality are desirable in the Boer pumpkin.

There is a prospect that the field-pumpkin mentioned in the previous report could largely replace the Boer pumpkin. This pumpkin has a high resistance to powdery mildew, produces at least twice the yield of the flat white Boer pumpkin and has a better keeping quality. The flesh is deep orange in colour and the table quality is very good, but because this type is more watery than the Boer pumpkin, there will always be a demand for the drier Boer pumpkin.

However, this field-pumpkin is not uniform and it is susceptible to sunburn. A few breeding strains with different shapes were obtained by means of inbreeding and will be tested for yield and other properties. A breeding strain with a yellow peel which is more resistant to sunburn was obtained. Selection and inbreeding with the flat white Boer pumpkin are proceeding, the object being to obtain greater uniformity and a better flesh colour.

MUSKMELONS

Breeding

The cool, wet summer in the winter rainfall area resulted in losses for muskmelon producers. The conditions were especially favourable to downy mildew *Pseudoperonospora cubensis*. Sprays were ineffective after the disease had infected the leaves. The plants were defoliated and the muskmelons suffered sunburn.

The breeding programme was continued, with special emphasis on the hard-skinned types suitable for export by sea. The market for muskmelons exported by air is small and the cultivar Ogen is able to supply the demand.

A storage trial was carried out to establish the best harvesting stage and handling procedures for Honeydew. According to the results Honeydew can be harvested as soon as the blossom end yields slightly to pressure. No preparations were effective in preventing the occurrence of *Rhizopus* rot of muskmelons after packing.

Diseases

A number of local and imported cucurbit species, cultivars and breeding strains were tested for virus infection. Watermelon mosaic virus was found in all the plants infected with the virus. Such plants show abnormal leaves, with mosaic and raised scars. The identity of the virus was confirmed with the aid of the electron microscope.

Over 50 different plants, including cucurbits, were tested for cucumber mosaic virus. All the tests, including those carried out with the aid of the electron microscope, were negative for this virus, which is common in Europe and America but has not yet been observed in South Africa.

GREEN BEANS

In trials carried out by the Horticultural Research Institute at all its substations throughout



An improved field-pumpkin variety that was developed through breeding and selection

the country the relatively new cultivar Thor again produced very good results, especially with regard to yield and quality. Yields of over 15 t/ha of good quality green beans can be obtained with this cultivar under good cultural conditions.

The pods, which are of a very high quality, can remain on the plant for a relatively long period, which has the advantage of boosting the yield enormously without the quality necessarily suffering. Furthermore, a single harvesting is successful with this cultivar. However, Thor has a few disadvantages such as poor resistance to bacterial blight, crooked pods and a luxuriant growth habit which makes the plants lodge easily, with the result that the ends of the pods trail on the ground.

Evaluation trials in the course of which cultivars were artificially infected with bacteria of the most important disease, bacterial blight, indicate that most cultivars, including a number of new cultivars that have been imported, do not have the required resistance to the disease. The best and most reliable disease-resistant fresh market cultivar is still Seminole. In order to ensure a fairly high quality, pods of this cultivar should be harvested young.

A number of other breeding strains, some imported and others obtained from the Horticultural Research Institute, also showed very high resistance to the disease. These strains will undergo further selection in the breeding programme of the Institute, after which they will be inbred and used as breeding parents.

The green bean breeding programme has shown good progress with the development of disease-resistant breeding strains that can be mechanically harvested. This material is at the development stage at present and is not yet available for distribution.

Halo blight of beans *Pseudomonas phaseolicola*

- (a) *Field trials* - It was again shown that the method developed for testing bean cultivars and breeding strains in the land for resistance to halo blight is effective.
- (b) *Glasshouse trials* - The isolate of *P. phaseolicola* used in the above trials was identified as race 2. Other isolates, which were identified several years ago, were also found to belong to race 2. Race 2 appears to be dominant in South Africa.

Considerable progress was made with the development of a method of testing bean cultivars and breeding strains in the glasshouse for resistance to halo blight.

Virus diseases

A hitherto unknown virus in South Africa was isolated from Witsa beans. The virus has a large number of hosts and a very high temperature (80 to 90 °C) is required to kill it.

GREEN PEAS

Processed green peas are still in great demand, and the demand has risen steadily over the past few years, especially in the case of frozen peas, which constitute about 40% of all frozen vegetables. The quantities canned and frozen in 1976 were not sufficient to meet the demand in South Africa.

Attempts to boost the local production of green peas were hampered by several problems. The chief problem is that the optimum planting time in the various areas is very short owing to unfavourable temperatures early and late in the season. This means that there is a very limited period during which producers, using manual labour, and factories, using threshing machines, can harvest the crop. A partial solution would be to extend plantings to areas where the planting time is different or to breed cultivars that are better adapted to unfavourable temperatures. Work on breeding such cultivars is in progress.

Breeding and cultural trials

Good progress was made over the past year at the Horticultural Research Institute with the development of cultivars that produce higher yields than those available at present. Two breeding strains that are already in the sixth generation are particularly promising in respect of high production and it should be possible to make them available in two years' time provided their performance is satisfactory in all respects.

Twenty-eight crossing selections derived from crossings with the so-called winter hardy strains and cultivars are being tested for resistance to low temperatures. Further crossings have been made with a few multiseminal breeding strains received from England. Seed samples of a number of new promising cultivars were imported and will be investigated in evaluation trials as soon as sufficient quantities of seed are available.

Research to predict when peas ripen in particular weather conditions is being continued. The results obtained so far indicate that it is possible to predict the harvesting time for a particular cultivar in a particular area very accurately with various planting times.

CABBAGES

A severe black rot infection (*Xanthomonas campestris* and *X. aberrans*), which causes brown spots on the leaf margins in cabbage, occurred. This infection attacked from the outside and the first symptoms were visible a few weeks after a mild hail storm. There were major differences in susceptibility and resistance in cultivars and breeding strains. The cultivar Cape Spitz showed a high resistance, but All Head (Horticulture selection) was very susceptible. Two breeding strains, Badger 15 and Badger 18, which have been grown locally for four years, showed high resistance. Badger 18 was the most outstanding. The yield was good, and the heads round and very compact with a small internal stalk. If the seed

production problems of this breeding strain can be solved during the next few seasons it could profitably be released as a new cultivar.

Breeding strains 1 and 2 from Gloria Osen hybrid cabbage were susceptible to browning of the leaf margins, but the disease occurred in a less severe form in No. 2. An inbred generation of No. 2 was more susceptible, however. Selection 2 is also performing well in the Western Cape and Natal and is yielding a normal seed crop under South African conditions. The release of this selection as a new open-pollinated cultivar is being considered.

Cultivars such as Chogo and RA Cross produced very good results in Natal. Gloria Osen and Pak-Rite No. 42 did well in the Western Cape.

CAULIFLOWERS

Cauliflower cultivars and breeding strains in the early and early midseason group, i.e. those with a development period under about 80 days, are still causing problems and make a poor showing unless conditions are ideal. Producers always take a risk in planting the short-season cultivars such as Snowcrown, Extra Early Six Weeks and Cumulus. The midseason cultivars such as some of the Snowball types and Igloo and the late cultivars such as Canberra and Snowcap perform consistently well in all the production areas.

In the cauliflower breeding programme where some of the early breeding strains of the Horticultural Research Institute which have a development period of 35 to 45 days were crossed with the good late cultivar Barrier Reef (about 130 days), good selections were made from the early midseason group. The selections grow luxuriantly and have a good head quality and high quality. These selections are undergoing further selection and evaluation.

In the Western Cape, where there is also a great need for early cultivars, it has been found that the yield can be improved a great deal by better fertilising practices, especially by the application of a topdressing of nitrogen and potassium at an earlier stage after transplanting.

In an attempt to multiply certain cauliflower breeding strains, attempts were made to grow them by the tissue culture technique. The tests were very successful. It is now possible to grow adult plants that will produce seed from the tissue structure of the edible fleshy inflorescence.

CHILLIES

In recent years manufacturers of spices and food processors have shown a great deal of interest in local supplies of chillies. There has been a sharp increase in demand and producer prices have risen considerably.

The harvesting and drying of the fresh ripe fruit is a labour-intensive process and so most farmers harvest once, during the early winter months when the fruit has dried on the plant. With this system yields of up to two tons of dried fruit per hectare are obtained with the cultivar Long Red Cayenne.

Trials at the Horticultural Research Institute revealed that with this harvesting method producers forfeit up to half the yield they would have obtained if ripe fruit had been harvested at regular weekly or fortnightly intervals.

Where regular harvesting is practiced the plants are able to produce new flowers and fruit continuously until they are killed by frost in the winter. A good yield of up to 22 tons of fresh fruit can be obtained with Long Red Cayenne, which is equivalent to dry yield of about 4,5 tons per ha.

The drying of fresh fruit causes problems in several districts, but if the weather is favourable or drying kilns are available, a dry product of very high quality is obtained. On the other hand there is a loss of quality with the single harvesting method because fruit is allowed to remain on the plants for a long period. The trial showed that up to 30% of the fruit dropped from first grade to second or third grade.

ONIONS

Attempts are being made to breed an early, firm, round onion with good keeping quality for the northern short-day production areas. Selections have already been made and are undergoing further inbreeding. For the first time Hojem selections (early) were free from purple and white bulbs. This selection has so many favourable properties that breeders' seed will be made available to the Division of Plant and Seed Control as soon as possible.

It appears from the results of trials at the Glen, Addo and Nelspruit substations that the present early Hojem selection performed best of the short-day cultivars. This firm, almost round onion with its very strong scale leaves should prove generally acceptable.

A Creole selection which is free from purple bulbs and a selection from the breeding strain 29 b-2-1-2 were among the outstanding selections at Roodepoort. 29 b-2-1-2 yielded promising results in dehydration trials.

Onion cultivars, first generation hybrids and white onions for dehydration imported from the USA produced a high percentage of bolters. The only exception was Premium Early Yellow (F_1), which was early and had a low percentage of bolters, but was not so suitable for dehydration as the others.

Owing to irregularities in bulb shape and size it was decided that the breeding strain 322, a fairly early round onion for the northern production areas which was reported on last year, should be held back until it has undergone further purification through selection.

Good progress was made with the inbreeding of selected Caledon Globe and Australian Brown onions at Elsenburg. All the results indicate that the process will lead to a great improvement in the uniformity and keeping quality of the two cultivars. The available seed of the two cultivars still lacks these two properties, which causes problems with regard to exporting.

Diseases - The stand of onion seed near Oudtshoorn (Schoemanshoek) was attacked by a serious disease during the year under review (September, October 1976). Large, yellowish-white spots, in some cases surrounded by a greenish watery margin appeared on the seed stalks, especially where they were swollen. In addition to these large lesions several small, oblong yellow spots, most of which were slightly depressed, were visible on the stalks. The tissue in the centre of many of the spots was torn. As a result the seed stalks broke and lodged.

The disease is thought to be due to -

- (a) sudden transition from winter to summer weather; or
- (b) infection by the weak parasitic fungus *Stemphylium* sp. This fungus sporulates strongly on leaves affected by downy mildew *Peronospora destructor* and *Alternaria* leaf spot *Alternaria dauci* f. sp. *porri*. It is thought that *Stemphylium* from these leaves attacks the stems.

It is therefore recommended that downy mildew and *Alternaria* leaf spot should be properly controlled. If control is successful the new disease should not become a problem.

Research on the severe *Fusarium* bulb rot is showing good progress.

SWEET POTATOES

Breeding - Over the past decade it has been obvious on a large variety of soil types that few cultivars can compare with Impala with regard to yield. This cultivar remains popular, despite its relatively poor vine growth. Strong vine growth does not appear to be related to heavy bearing.

In a trial carried out at Roodeplaat during the year under review, the five best yields were obtained from strains with fairly poor vine growth. The only exception was the breeding strain 73-1-75, which has a fairly strong vine growth. This is a short, thick, dull pink sweet potato with creamy yellow flesh, which produces good yields throughout the Republic. The keeping quality is very good, even without any post-harvesting treatment.

Another breeding strain which produced excellent results over the past five years is 71-12-6. This is a pink, sausage-shaped sweet potato with a smooth skin. The flesh colour is white to pale cream. The yield is very good and although the vine growth is not very vigorous, it is nevertheless better than that of Impala.

The breeding strains 73-1-103 and 73-1-67 are also promising, although the latter, which performed so well the previous year, produced poor results last season.

Cultural trials at Nelspruit showed that the virus-purified Kenia remains a shy bearer. Despite its very good quality and keeping quality Kenia will therefore not be grown on a large scale. In the Lowveld tubers are being eaten to an increasing extent by the larvae of the *Blosyrus* beetle. Very little is known about this insect.

Attempts are being made at all the other substations to obtain early propagating material by manipulating planting times. Early commercial planting is important if better yields and better market prices are to be obtained. The overwintering of plants after late planting (February) appears to be producing promising results.

Sweet potato exports to Europe have not shown the desired increase, mainly because of poor prices and high export costs. Another problem was that the sweet potatoes generally arrived overseas in a very poor condition. The reasons were that mechanically damaged and insect-damaged sweet potatoes were sometimes packed and that few of the sweet potatoes received a post-harvesting treatment at a high temperature and humidity. This treatment, which causes all wounds to callus and therefore prevents direct penetration, is a requirement for long storage. It ensures that the quality of stored sweet potatoes remains high which is essential for export potatoes. The necessary information on this treatment has been available in pamphlets issued by the Department of Agricultural Technical Services for years, but is not yet applied by producers and exporters.

Diseases - Large-scale trials in which indexing by grafting was used to determine how long sweet potatoes in isolated plantings in the field would remain virus-free were started. Virus-indexed material of eight cultivars and two breeding strains was planted in the field and continually re-indexed to determine the level of virus infection. After a period of six months in the field no virus infection could be found in the material even after over 40 transmission indexings.

ANCILLARY RESEARCH

Cherry plant improvement scheme

During the winter of 1976 virus-tested propagating material from the cherry experimental farm at Ficksburg was issued to approved growers participating in the plant improvement scheme. The material issued consisted of 25 660 buds of cherry cultivars and 630 rooted rootstocks.

The cherry plant improvement scheme has now been in operation for four years and it is anticipated that from 1977/78 growers will be in a position to meet the entire cherry industry's demand for certified trees.

Sweet potato plant improvement scheme

Virus-tested sweet potato vines of the most important commercial sweet potato cultivars were again made available to approved growers this year. During the year under review a total of 281 000 vines from Roodeplaat were issued to growers.

Strawberry plant improvement scheme

The Horticultural Research Institute made 1 840 virus-tested foundation plants of the four

most important strawberry cultivars available to growers in the summer rainfall area who are participating in this scheme. The growers multiply the foundation plants under the supervision of the Division of Plant and Seed Control to serve as parent plants for planting and multiplication for the industry the following year.

Rose plant improvement scheme

During the year under review 146 100 unrooted virus-tested shoots of the chief rose rootstocks from Roodeplaat were issued to rose growers. This total included 58 000 shoots of the Brooks 1948 rootstock cultivar, 18 000 of Basye No. 3 and 32 000 of Clarke No. 1957.

PLANT AND SEED CONTROL INSPECTION SERVICES

CONTROL OVER THE SEED TRADE

Registration of sellers/cleaners of seed

Registered sellers and cleaners of seed now number 332 and 70, respectively - a total of 402 as against 413 the previous year. The registered sellers and cleaners of seed are distributed over the four provinces as follows:

	Transvaal	Cape	Natal	OFS	Total
Cleaners	35	17	8	10	70
Sellers	130	119	51	32	332
Total	165	136	59	42	402

Control over the cleansing and sale of seed

There are 815 seed distribution points to be visited. In all 2 603 inspections were carried out for the purposes of the Seeds Act. This is a decrease of 97 in comparison with the previous year. The number of seed samples taken for the testing of germination, physical purity, weed-seed content and/or variety purity and trueness was 2 684 - 18 less than during the previous year. The following table indicates the kinds which showed the most quality defects:

Defects	Kinds
Germination too low	Forage turnips, peppers, tall fescue, peas, sorghum, cowpeas, medics, parsnips, parsley, cotton, lupins
Purity too low	Teff, rye grass
Too much weed seed	Teff, rye grass, carrots
Variety trueness unsatisfactory	Beetroot, onions, rye grass

Advertisements in magazines were investigated and 24 persons who were selling seed without being

registered as sellers of seed were traced. Eleven different types of offence, mainly in connection with the sale of seed, can be identified.

Sealing lucerne seed

The following quantities of lucerne seed were approved and sealed after being found to be free of dodder and to meet the requirements for purity and germination:

Place where approved	Mass of seed approved and sealed (kg)	
	1976/77	1975/76
Oudtshoorn/Ladismith	1 291 900	857 900
Upington	50 240	39 200
Johannesburg	22 500	54 558
	1 364 640	951 688

The quantity of lucerne seed sealed was 45 per cent higher than during the previous year.

Seed certification

This function includes the administration and application of the following schemes which have as their object the production of seed of a high quality:

- (a) *The Basic Seed Scheme*, in terms of which basic seed for the production of certified seed is grown under the Seed Certification Scheme and the OECD Scheme.
- (b) *The Seed Certification Scheme*, in terms of which variety-pure and variety-true seed of known origin is grown.
- (c) *The Export Seed Scheme*, in terms of which only basic seed supplied by overseas seed firms is multiplied in the Republic under official supervision.
- (d) *The OECD Herbage and Oilseeds Scheme*, which is similar to the Seed Certification Scheme, but enjoys international recognition.

The following table indicates the mass (kg) of seed certified in terms of the various schemes.

Production under the OECD Herbage and Oilseeds Scheme remained fairly constant, especially in the case of lupin seed.

The largest quantities of seed certified were of the following kinds: maize, lupins, cotton, peas, beans, carrots, beetroot, cucurbits, onions, cabbage, blue buffalo grass and rye grass.

The production of certified vegetable seed, especially pea, pumpkin, garden bean and cabbage seed, was lower than the previous year, but the production of grasses increased considerably. The production of certified dry bean, lupin and cotton seed rose sharply. More than twice as much yellow as white hybrid maize seed was certified; the previous year the quantities were about equal. The quantity of certified hybrid maize seed cultivated (25 559 019 kg) was lower than during the previous year, mainly because firms are starting to supervise the production of their private hybrids themselves.

Crop group	Basic Seed Scheme	SA Seed Certification Scheme	Export Seed Scheme	OECD Herbage and Oilseeds Scheme	Total
Vegetables	16 373	1 517 875	33 610	-	1 567 858
Field crops	787 571	26 046 899	-	830 563	27 655 033
Pastures	16 805	38 626	-	-	55 431
Total 1976/77	820 749	27 603 400	33 610	830 563	29 288 332
Total 1975/76	467 301	31 694 757	71 326	865 067	33 089 451
Total 1974/75	599 602	37 311 591	33 380	492 125	38 430 698

The following are the most important of the maize hybrids of which seed was certified:

White: SSM 35, PP X K64r, NPP X K64r, SA5, SSPP X K64r, SA 9N.

Yellow: SSM 42, SSM 40, SA 4, SA 100.

Fairly good growing conditions in various areas helped boost seed production.

The following table indicates the number of inspections carried out and the total area inspected per crop group:

Crop group	Number of inspections	Total area inspected and approved (ha)
Vegetables	1 699	3 552
Field crops (excluding maize)	307	7 763
Hybrid maize: white and yellow	5 218	22 496
Pasture crops	44	474
Total: 1976/77	7 268	34 285
Total: 1975/76	6 940	29 737

In all 25 seed merchants and co-operatives and 776 growers participated in these schemes. Seed of 26 kinds and 153 varieties was certified.

South Africa continued its membership of the OECD Herbage and Oilseeds and Vegetable Seed Schemes.

The 1977 annual meeting of representatives of certification authorities under the OECD seed schemes took place in Paris on 26 and 27 April 1977. South Africa was represented at this meeting by Mr L.J. Grobler, Assistant Director of the Division of Plant and Seed Control.

In terms of an EEC resolution taken on 17 May 1976, the equivalence South Africa obtained for certified seed under EEC guidelines was extended to a further member of field and forage crops.

Equivalence for certified vegetable seed was obtained from the United Kingdom in terms of EEC guidelines.

Equivalence of this nature promotes and facilitates the exporting of seed to EEC member countries.

SEED POTATO CERTIFICATION

(a) Foundation seed potatoes (first multiplication)

Virus-free and variety-true breeding material from Departmental establishments is multiplied in

plots at Sabie. The following quantities were produced:

Variety	Number of units (30 kg)
BP 1	1 875
Up-to-date	779
Van der Plank	250
Total	2 904

In order to prevent the transmission of virus diseases, the cultivation of any potatoes within a demarcated area around the Sabie plot was prohibited by proclamation.

A donation for the erection of two necessary sheds was received from the Potato Board.

(b) Foundation seed potatoes (second multiplication)

The multiplication of foundation seed potatoes from the Sabie plot is undertaken by the Potato Board at plots at Lydenburg. The multiplication is subject to official inspection, mainly for the presence of viruses, and certified foundation seed potatoes are sold to the industry for the production of certified seed potatoes. The cultivation of potatoes within a certain area around the plot is prohibited by proclamation. The following quantities of foundation seed potatoes were certified:

Variety	Number of units certified (30 kg)
Up-to-date	6 013
BP 1	4 833
Van der Plank	1 366
Late Harvest	351
Koos Smit	155
Total	12 718
1975/76	8 377

(c) AA certification regions

- Field screening* - In the AA area, which is situated chiefly in the Northern Cape, the OFS and to a lesser extent in the Transvaal, Natal and the Western Cape, 5 246 ha was submitted for inspection. This is about 900 ha more than during the previous year. Some 501 ha was rejected, mainly because of too high a level of virus infection, the chief viruses being leaf roll and mosaic in the Up-to-date plantings and Yn in the BP1 plantings.

- (i) *Tuber inspection* - The quantity certified was 778 377 x 30 kg, as against 619 546 x 30 kg the previous year. About 81 800 x 30 kg was rejected, chiefly for exceeding the tolerances for nematode and potato tuber moth infestation, rotted tubers and infection with *Rhizoctonia solani*.

(d) A certification regions

- (i) *Field screening* - A class seed potatoes are grown chiefly in the Transvaal, the Eastern and Central Free State, Natal and the Western Cape. Only 155 ha of the 4 414 ha submitted for certification was rejected, the main reason being Yn virus infection in BP1 plantings.
- (ii) *Tuber inspection* - 747 921 x 30 kg of tubers was certified, as against 626 711 x 30 kg the previous year - an increase of 121 210 x 30 kg. 43 843 x 30 kg was rejected for exceeding the nematode and potato tuber moth infestation tolerances and for rotted tubers.

(e) General

- (i) *Varieties* - The relative importance of varieties of which seed potatoes were certified is indicated in the following table:

Variety	Quantity (x 30 kg units) of seed potatoes (all classes included) certified	
	(1976/77)	(1975/76)
Up-to-date	516 364	490 330
BP1	697 908	488 246
Van der Plank	188 905	184 358
Koos Smit	31 060	29 302
King George	21 163	24 573
R100	12 680	
890/20	18 277	
Pimpernel	9 784	
Kimberley Choice	19 962	
Other	11 095	
Total	1 526 298	1 216 809

- (ii) The practice of removing foliage before virus-infected winged aphids from commercial plantings enter the seed lands is proving very effective in preventing virus infection.
- (iii) *Performance tests* - In all 2 138 samples were planted for purposes of performance testing. The tests give an indication of the efficiency of virus disease control by seed potato producers, whose continued membership of the scheme depends on the outcome of these tests.

PLANT IMPROVEMENT SCHEMES

The plant improvement schemes in operation at present have no legal status and are administered solely on the basis of voluntary participation. Under the new Plant Improvement Act of 1976 it will be possible to establish schemes governed by regulations.

Vines

(a) Parent blocks

(i) Rootstocks

A further 31 180 rooted rootstocks were established in approved blocks, which brings the total to 503 995. 45 182 selected rootstocks were withdrawn during the year for various reasons. The following numbers of rootstocks qualified for certification:

Scions: 2 521 500

Cuttings for planting: 1 860 000

Rooted rootstocks: 123 000

Two heat-treated rootstock plantations of Richter 99, 101-14 and Jacques were established.

(ii) Scions

There is no suitable material of table or wine grape varieties available as yet.

Drapes and pomes

(a) Parent blocks

(i) Rootstocks

Twelve nurserymen established plantings of Marianna rootstock under the Super Grade Scheme during 1976. During 1977 Marianna, Kweper A, M 793, B 12 and MM 106 rootstock material was issued to selected nurseries for planting.

(ii) Scions

Visually approved nursery material is being grown by 11 nurserymen. The following table shows the scale of production:

Kind	Number of varieties	Number of trees that qualify as propagation sources	Expected number of certifiable trees
Apples	4	909	35 181
Peaches	8	736 165 333	
Pears	5	377	46 488
Plums	3	240	31 410
Prunes	1	76	146
Apricots	3	47	109 775
Total	24	2 385	388 333

(b) Nursery blocks

(i) Rootstocks

84 600 Marianna and 3 000 Kweper A cuttings have been issued in terms of the Super Grade Scheme to approved nurseries for establishment. Large quantities of rootstock material from the parent blocks will also become available.

(ii) Scions

Scion material in terms of the Super Grade Scheme is being grown at Ceres by the South African Plant Improvement Organisation and

budding material will be issued to approved nurseries for the first time during the summer of 1977/78.

Strawberries

The scheme is still progressing favourably and is making a positive contribution to the improvement of the yield and quality. Eight nurserymen are participating in the scheme and the following numbers of plants of the various varieties were certified:

Parfait	1 003 000
Selekta	470 300
Tioga	465 400

Cherries

1 907 trees at two nurseries were certified.

INSPECTION OF FLOWER BULBS FOR EXPORT

The area and number of bulbs inspected were larger than the previous year.

Winter bulbs

Sixteen bulb varieties, covering an area of 76 ha and producing 88,7 million bulbs, were submitted for inspection. The most important varieties were *Ranunculus* and *Ornithogalum*.

Summer bulbs

A total area of 20,7 ha, on which seven varieties, producing 2,4 million bulbs, were grown, was submitted for inspection and approved. *Amaryllis* was the most important variety.

Chrysanthemums

Production virtually doubled in comparison with the previous year. Inspections were carried out at two nurseries with a view to exporting cuttings and 35 million cuttings were approved.

NURSERY INSPECTIONS

At present nursery inspections are aimed chiefly at preventing the spread of proclaimed noxious plant diseases and pests.

Registration

Altogether 1 682 nurseries, 393 of which are vine nurseries, were registered with the Department. Half the general nurseries are situated in the Transvaal, and most of the vine nurseries are in the Cape Province.

Diseases and pests

Thirty nurseries, five of which are in the Transvaal, 24 in the Cape Province and one in Natal, were placed under quarantine.

Quarantine was imposed chiefly on account of the following diseases and pests: nematodes, red scale, Ross scale, pernicious scale, white peach scale and crown gall.

Stocks in nurseries

The following table shows the number of trees or plants together with the most important kinds or cultivars available in registered nurseries:

Group or kind	Total 1976/77	Most important kinds or cultivars	Total per kind or cultivar
Peaches	1,8 million	Kakamas Prof. Neethling Oom Sarel Keimoes	286 300 265 200 226 600 87 700
Plums	241,6 thousand	Sungold Santa Rosa Methley	63 100 49 300 24 200
Apples	582,4 thousand	Granny Smith Star Crimson Starking	230 700 115 800 81 200
Apricots	479,8 thousand	Bulida Royal	200 400 141 800
Citrus	509 thousand	Valencia Navel Grapefruit	151 100 117 100 61 600
Subtropical fruit	-	Avocado Mango Loquat Litchi	97 600 72 700 44 900 24 100
Nuts	417,5 thousand	Macadamia Pecan	272 200 131 100
Ornamental shrubs, trees and glass-house plants	61,5 million	Forest trees Ornamentals Glasshouse plants Roses Shrubs Hedge plants Palms	34 200 10 100 4 100 2 800 2 700 2 200 426 700
Vines	-	-	-
Grafted vines	12,9 million	-	-
Rooted ungrafted vines	835 000	-	-

PEST CONTROL

Bacterial blight survey in vineyards

About 697 700 vines were inspected for bacterial blight. No new infections were found. Quarantine was raised in the case of two plots.

Inspection of fruit for scale

627 346 units (4 120 of which were rejected) were inspected for the presence of scale. The inspections were carried out on fruit intended for export.

Compulsory orchard sanitation

With a view to the compulsory control of pernicious scale and grey scale 987 spraying orders were issued to owners of infested plots in the ten proclaimed districts of the Western and South-western Cape. The average percentage control obtained was 69. In all 232 samples were taken in order to determine the presence of live insects and identify the scale.

Control of European red mite

Two infested plots were successfully treated.

Control of wart disease in potatoes

In order to trace any possible unauthorised plantings of potatoes in the declared area, inspections were carried out in the following districts: Ermelo, Belfast, Carolina and Hendrina. In one case a producer was ordered to remove a planting.

Embargo on the transportation of banana plants

In order to prevent the spread of burrowing nematode *Radopholus similis*, no person is permitted to transport or allow to be transported any banana propagating material in the Transvaal or Natal without a permit. Twenty permits were issued after 30 samples had been analysed and no infestation found.

QUALITY CONTROL IN RESPECT OF IMPORTED AND EXPORTED PLANTS, PLANT PRODUCTS AND SEED

The Division is empowered in terms of the Seeds Act and the Agricultural Pests Act to exercise control over the quality and/or phytosanitary condition of plants, plant products (including seed), bees and apiary products that are imported and exported. Certain standards are laid down for the quality of imported seed.

As a member of the International Plant Protection Convention South Africa is involved in a world-wide campaign to prevent noxious diseases and pests of plants and plant products from crossing national boundaries.

A government consultation on the International Plant Protection Convention was held in Rome from 15 to 19 November 1976. South Africa was represented by Mr J.F. van Wyk, Director of the Division of Plant and Seed Control. Several proposed amendments to the Convention, aimed at defining the provisions more clearly, were adopted and will be submitted to the FAO Conference for approval.

Certain requirements with regard to the phytosanitary condition of any material imported into the Republic are laid down in terms of the

Agricultural Pests Act, and importation is subject to a plant import permit in which the requirements are specified. As evidence that the imported material meets the requirements, a phytosanitary certificate, issued by the authorities of the exporting country, must accompany each consignment. Similarly the Division issues phytosanitary certificates in respect of material exported where specific phytosanitary requirements are laid down by the importing country.

Imports

Seed declared under the Seeds Act

The table on the next page shows the various groups of seed and the quantities (kg) imported for various purposes.

The total quantity of seed imported virtually doubled in comparison with the previous year. The kinds that made the biggest contribution were maize and garden peas.

The largest quantities of seed imported were of the following kinds:

Vegetable crops: Cabbage, turnips, spinach-beet, watermelon, carrots, tomatoes, garden beans, garden peas, sweetcorn, gem squashes.

Field crops: Forage turnips, sorghum, maize, sunflowers.

Forage legumes: Medics, clovers, lucerne.

Forage grasses: Rough cocksfoot, tall fescue, rye grass, sorghum.

On the basis of the mass of seed imported, the various crop groups represented the following percentages, in comparison with the previous three years:

Crop group	1976/77 %	1975/76 %	1974/75 %	1973/74 %
Vegetable crops	41,82	27,86	47,80	42,99
Field crops	49,22	47,80	36,96	39,22
Forage legumes	1,94	14,09	3,13	1,43
Forage grasses	7,02	10,25	12,11	16,36

In all 1 750 lots of imported seed (as against 2 234 the previous year) were checked to see whether they met the prescribed import requirements.

Judging by the number of lots examined, Durban, Cape Town, Pretoria and Bethal are the chief importers of seed.

The following table shows the number of seed lots which, for various reasons, did not meet the import requirements, and the names of the kinds most frequently involved:

Defect	Num-ber of lots	Kinds
Germination too low	12	Tomatoes, parsley, blue lupins
Physical purity too low	1	Italian rye grass

Calculated on the basis of mass, 0,17 per cent of all seed did not meet the import requirements, which is a considerable improvement on previous years.

Group	Purpose for which imported						Total
	Commercial sales: listed varieties	Experiments	Multiplication for export	Commercial sales: unlisted varieties to relieve shortages	Re-exporting	Canning/Processing	
Vegetable crops	3 802 733	2 421	-	-	-	920 193	4 725 347
Field crops	4 475 410	1 571	130	14 000	73 600	-	4 564 711
Forage legumes	176 559	-	-	251 000	-	-	427 559
Forage grasses	638 389	1 340	-	-	-	-	639 729
Total	9 093 091	5 332	130	265 000	73 600	920 193	10 824 346
						1975/76	5 824 748

Plants, plant products, bees and apiary products

The following table shows the mass or quantity of the various types of imported material inspected for diseases and pests, together with the number of plant import permits relating to the mass or quantity concerned.

There was a marked increase in imports of tobacco, fruit, cotton lint, nuts and commodity seed in comparison with the previous year. However, the quantities of bulbs, timber, fibre products (cane, coconut hair) and herbs and spices were smaller.

8 527 phytosanitary inspections were carried out on imported plants, plant products and apiary products. This is 1 200 less than the previous year. A total of 1 698 plant import permits were issued.

In all 711 consignments were held back on account of inadequate documentation, prohibited imports such as honey, and infestation by insects, mites, scale or nematodes. The following action was taken: documentation rectified or consignments destroyed, fumigated, treated or reconsigned to the country of origin.

Exports

(a) Seed declared under the Seeds Act

Compulsory quality control is applied to export lupin seed only, chiefly in order to comply with EEC requirements. In terms of its powers under the EEC guidelines, West Germany prohibited the importation of uncertified lupin seed with effect from 1 July 1977.

International seed analysis certificates are issued on a voluntary basis. 329 certificates of this type, covering 3 541 177 kg of seed (chiefly lupine, serradella, babala, Rhodes grass and weeping love-grass seed) were issued.

(b) Plants and plant products

The table on the next page shows the mass or quantity of the various types of export material inspected for diseases and pests, together with the number of phytosanitary certificates issued after such inspections (which often included the inspection of the plants during the growing stage).

The quantities of seed, table potatoes, maize, fruit and cut flowers submitted for phytosanitary certification were lower than last year. On the other hand, larger quantities of seed potatoes, vegetable plants, cuttings and bulbs were certified for phytosanitary purposes.

In all 13 248 phytosanitary certificates were issued, which is 274 more than the previous year.

QUALITY CONTROL

PLANT INTRODUCTION AND THE STORAGE OF GERM PLASM

It is the official policy that all imports and exports of samples of plant propagating material on behalf of Departmental bodies should be handled by the Division.

Nature of imported material	Mass or quantity inspected (kg unless otherwise indicated)	Number of plant import permits concerned	Nature of imported material (kg unless otherwise indicated)	Mass or quantity inspected (kg unless otherwise indicated)	Number of plant import permits concerned
Plants and cuttings	3 263 887 units	510	Nuts	2 188 899	-
Bulbs, tubers and rhizomes	24 997 118 units	130	Timber	202 830m ³	-
Seed potatoes	485 646	21	Herbs, spices, ginger, etc.	2 384 924	17
Seed (declared under the Agricultural Pests Act)	11 562 365	717	Cut flowers (fresh and dried)	25 855	4
Potatoes (table)	61 000	4	Fibre, cane, peat moss	6 234 298	9
Tobacco	21 267 525	58	Commodity seed (not declared)	195 981 455	53
Fruit	1 152 330	9			
Cotton and cotton samples	28 223 381	155			
Broom-reeds	5 000	2			
Beeswax	29 797	9			

Nature of exported material	Mass or quantity inspected (kg unless otherwise indicated)	Number of phytosanitary certificates issued	Nature of exported material	Mass or quantity inspected (kg unless otherwise indicated)	Number of phytosanitary certificates issued
Seed (general)	14 396 207	1 235	Potatoes (seed)	7 366 039	134
Plants and cuttings	33 998 588 units	580	Potatoes (table)	9 428 372	401
Bulbs, tubers and rhizomes	57 099 696 units	493	Maize	2 201 373 880	944
Cut flowers (fresh and dried)	950 406	2 672	Vegetables etc.	19 365 490	3 144
Other (wheat, ground-nuts, etc.)	210 763 647	628	Fruit	492 434 006	2 572
Timber	1 223m ³	27			

The significant increase of the past few years in the number of samples handled was maintained, as is clear from the following table:

Item	1976/77	1975/76	1974/75	1973/74
Number of samples exported for research	10 587	4 707	4 129	1 969
Number of samples imported for local researchers	2 943	4 159	3 205	2 105
Number of samples imported for rust gardens	9 115	8 922	8 983	9 019
Total handled	22 645	17 788	16 317	13 093

The plant material handled belonged chiefly to the following kinds: wheat, maize and fruit. The Division of Plant and Seed Control co-operates closely with international organisations and overseas researchers with regard to the exchange of plant germ plasm.

All data on germ plasm is stored on computer tape and the addition, withdrawal and tracing of samples is therefore much faster. Data on the following clones/varieties, which are being maintained, were obtained from the institutes concerned: Wine grapes 214, apples 198, peaches 98, vine rootstocks 88, plums 64, nectarines 38, apricots 37, pears 29 and almonds 18. A further 1 002 items were admitted to the cold storage unit.

Variety control

Variety control comprises two types of function, viz:

- Granting recognition to varieties with a view to including them in the varietal list, which is kept in terms of the Seeds Act, and/or the award of plant breeders' rights under the Plant Breeders' Right Act; and
- the determination of the variety trueness and purity of material from recognised varieties that are being introduced into the trade.

The purpose of the varietal list is to avoid the sale of the same variety under various names or various varieties under the same name.

Before propagating material of a variety of a declared kind may be sold in the trade or imported, the name of that variety has to be included in the varietal list.

Any person who has an interest in a new plant which originated in the Republic or in a country with which a reciprocal agreement has been entered into in terms of the Plant Breeders' Rights

Act, can protect his rights with regard to such plant by having recourse to the Act.

The holder of plant breeders' rights enjoys:

- the sole right to sell propagating material for a certain number of years; and
- the right to collect royalties from persons to whom licenses have been granted for the sale of such material after the expiry of the period of sole right or after the granting of final plant breeders' rights.

Recognition of varieties

The requirements a variety must meet are basically the same for inclusion in the varietal list and the award of plant breeders' rights, viz it must be distinguishable from existing varieties of the same kind, homogeneous and stable. This means that all candidate varieties have to be examined in accordance with certain guidelines, which usually include growing the adult plants.

The following table shows the kinds, and the number of varieties of each kind, for which applications for inclusion in the varietal list were received:

Kinds	Number of varieties			Total
	Locally bred Official	Private	Bred overseas	
Maize	-	22	7	29
Tomatoes	1	-	7	8
Grain sorghum	-	1	5	6
Cauliflower	-	-	6	6
Soya-beans	-	-	5	5
Cotton	-	2	2	4
Onions	1	-	3	4
Dwarf beans	-	-	3	3
Sweetcorn	-	-	3	3
Cabbage	-	-	2	2
Carrots	-	-	2	2
Lucerne	-	-	2	2
Cattle melons	2	-	-	2
Peas	-	-	1	1
Cucumbers	-	-	1	1
Subterranean clover	-	-	1	1
Cowpeas	1	-	-	1
Muskmelons	-	-	1	1
Total 1976/77	5	25	51	81
Total 1975/76	9	11	54	74
Total 1974/75	3	22	41	66
Total 1973/74	3	42	51	96

The most important kinds in respect of which applications were received were maize, tomatoes, grain sorghum, cauliflower and soya-beans. Locally

developed varieties constituted about one-third of the total submitted.

The following table indicates the kinds, and the number of varieties of each kind, included in the varietal list:

Kinds	Number of cultivars included in the varietal list	
Maize	21	
Cauliflower	6	
Tomatoes	4	
Grain sorghum	3	
Dwarf beans	3	
Garden beet	3	
Sweetcorn	3	
Cattle melons	2	
Tall fescue	1	
Castor-oil	1	
Gem squashes	1	
Soya-beans	1	
Total	1976/77	49
	1975/76	65
	1974/75	92
	1973/74	81

It is evident that (a) the number of varieties included in the list has shown a further drop in comparison with previous years and (b) the largest number of varieties included in the list belong to the following kinds: maize, cabbage and tomatoes.

Applications for plant breeders' rights were received with regard to new varieties of the following kinds (number of applications in brackets): dwarf beans (2), nectarines (2), roses (7), peaches (8), lucerne (2), apples (1), cotton (2), peas (1), pears (1), chinkerinchee (1), i.e. a total of 27 applications.

Since the Plant Breeders' Rights Act came into operation, breeders' rights have been awarded with regard to the following number of varieties: 3 beans, 1 grape, 3 soya-beans, 2 peaches, 1 plum, six maize varieties, 1 aloe, 6 tomatoes, 2 lupins, 1 tritiale variety, 4 roses and 5 proteas.

South Africa's application for membership of the International Convention for the Protection of New Plant Varieties, 1961, was successful. The Convention will be ratified within the next year, after which South Africa will join the other member countries on a reciprocal basis. A reciprocal agreement on plant breeders' rights was entered into by South Africa and Rhodesia in terms of the Plant Breeders' Rights Act. Under this agreement plant breeders' rights can be obtained in Rhodesia for new varieties developed in the Republic, and *vice versa*.

The Director of the Division of Plant and Seed Control represented South Africa as an observer at the annual meeting and a special board meeting of the Union for the Protection of New Plant Varieties (UPOV), which took place in October and November 1976 respectively. Officers of the agricultural section attached to the SA Embassy in Paris attended all meetings of the UPOV working groups on behalf of the Division of Plant and Seed Control.

Determination of variety trueness and purity

In terms of the Seeds Act the name of the variety has to be shown on the container in which seed is imported or sold. Samples of seed imported or distributed in the trade are continually taken and subjected to tests to determine, *inter alia*, whether the seed corresponds to the variety indicated on the container. This means that adult plants have to be grown from these samples for comparison with authentic specimens or descriptions of the varieties concerned.

The Division also carries out post-control tests on samples of seed grown under the certification schemes to confirm the variety trueness of the certified material.

For this purpose 4 522 samples of 58 kinds were grown in the Division's trial plots. Most of the samples tested were of the following kinds: maize (699) potatoes (441) beans (302), tomatoes (287), cabbage (186), carrots (178), grain sorghum (174), onions (171), peas (170) and beetroot (156).

In cases where the samples did not meet the requirements for the particular variety, the owners were informed with a view to the withdrawal of the seed lots in question from the trade.

BREEDERS' PLANT MATERIAL

The purification and maintenance of varieties was continued in co-operation with officers from several Departmental institutions, in order to obtain propagating material of a high genetic quality for use in the production of certified material. The following were the most important activities that were completed in this connection:

Maize - The purification of the inbred strains used for the production of public (SA) hybrids was continued. Seven strains are ready for final testing.

Japanese radish - The multiplication of seed of the new white-flowered selection of the Nooitgedacht variety was continued.

Cattle melons - Two promising strains passed the variety tests and will be released shortly.

Beans - In an attempt to control the major losses suffered annually as a result of bacterial disease of beans, a programme for growing disease-free seed was started. A glasshouse is used for the first multiplication, followed by field conditions in which the bacterial diseases cannot develop.

Tomatoes - Ten tomato varieties are in the process of purification.

Issue of breeders' material

The following quantities (kg) of breeders' material were issued to the seed trade:

Vegetables	167
Field crops	1 176
Forage grasses	514
Potatoes	87 120

ANALYSIS, EXAMINATION AND TESTING OF SEED

The Division renders an invaluable service in connection with control over the seed trade, seed certification, seed exporting and research on seed in that its seed testing station tests, analyses and examines seed samples for purity, germination, moisture content, weed content and other properties related to seed quality. The following table shows the total number of seed samples of field crop, horticultural and forestry species received by the Division for various purposes.

Most of the samples received for testing were of the following kinds: grasses, maize, sorghum, lupins, beans, peas, crucifers, cucurbits, tomatoes, onions and carrots.

34 463 individual tests were carried out, 17 187 of which were for germination, 8 405 for purity, 1 428 for defective seed, 3 164 for grading and 1 184 for weed content.

South Africa continued its membership of the International Seed Testing Association (ISTA).

The following officers of the Division serve on various committees of the Association:

Mr J.F. van Wyk	:	Executive Committee
Mr J.F. van Wyk	:	Seed Moisture and Storage Committee (Chairman)
Mr J.F. van Wyk	:	Flower Seed Committee
Miss E. Robert	:	Purity Committee

The Division is empowered to issue international seed analysis certificates.

PROPAGATING MATERIAL

Protein seeds and oilseeds

The losses suffered annually by the producers of dried beans as a result of seed-borne bacterial diseases are increasing all the time. It was therefore decided that the Plant Protection Research Institute should make small quantities of seed of the most important bean cultivars bacteria-free. This seed will then be multiplied in co-operation with the Institute for Crops and Pastures, the Division of Plant and Seed Control and the Dry Bean Board so that producers will eventually be able to obtain clean seed.

Over the past year small quantities of seed of 11 selected cultivars were purified from pathogenic

bacteria by the PPRI. This seed will be systematically multiplied.

Ancillary research

Effective *Rhizobium* strains for the manufacture of legume inoculants were again selected by the PPRI during the past year and made available to vaccine manufacturers. Strict control measures resulted in vaccine of outstanding quality being manufactured. The required minimum of 500 million bacteria per g of peat was far exceeded in most cases. Several lots of vaccine contained ten times the required quantity of bacteria.

Imports

The Plant Quarantine Station of the PPRI at Stellenbosch handled 136 import consignments of deciduous fruit, berry fruit and vines during the past year; 75 units were handed over to the horticultural institutions concerned for use in adaptation studies under local cultural conditions. The examination of a further 40 cultivars has not yet been completed, and 21 cultivars have been found to be infected with pollen or soil-borne viruses. Where healthy sources of these cultivars cannot be obtained from overseas, material will have to be subjected to heat therapy in order to eliminate virus infection before release.

Plant improvement

Good progress was made with the elimination of virus infection in clone selections of local cultivars. The first group of 15 table grape cultivars which is in a final phase of virus indexing was handed over to the Fruit and Fruit Technology Research Institute during the past year for ampelographic evaluation and eventual release to the South African Plant Improvement Organisation (SAPO). In addition a further 32 deciduous fruit cultivars, consisting of 16 pome and 16 drupe cultivars, which have already met the phytosanitary requirements for foundation material, were made available to the Fruit and Fruit Technology Research Institute for pomological evaluation.

The cherry plant improvement scheme was boosted when 19 scion and rootstock cultivars, which have met the phytosanitary requirements for foundation material, were made available to the Horticultural Research Institute. These included the popular cultivars Black Tartarian, Bing Emperor Francis and Heidelfinger as well as promising hybrids of the Mazzard rootstocks Fb 2/58/48 and Fb 2/58/38.

Seed group	Purposes						
	Certification scheme	Public	Trade checks	Export seed	Import seed	Research	Total
Field crops	3 340	3 549	1 671	356	438	342	9 696
Horticulture	824	4 350	1 222	6	923	159	7 484
Forestry	-	-	-	-	-	177	177
Total 1976-77	4 164	7 899	2 893	362	1 361	678	17 357
Total 1975-76	5 659	7 229	2 970	495	2 222	608	18 583

A second group of 16 wine grape and rootstock cultivars was handed over to the Oenological and Viticultural Research Institute (OVRI) for ampelographic evaluation and eventual release to the KWV plant multiplication organisation. This brings the total number of wine grape cultivars released after having met the phytosanitary requirements for foundation material to 30. This figure includes most of the important cultivars grown locally. This ought to produce a welcome improvement in yield and quality - the wine industry has had to contend with an exceptionally high degree of virus infection in its propagating material.

Artificial pastures

1. Plant introduction

During the year under review a number of very early strains of *Medicago truncatula*, *M. rugosa*, *M. polymorpha*, *M. turbinata* and *M. orbicularis* were obtained from Australia. They are being evaluated and multiplied at present. This material seems promising for veld improvement in the drier areas, including the Karoo.

Further introductions from Australia included 10 annual *Trigonella* spp. and the perennial species *Trifolium ambiguum*, *Glycine tabacina*, *G. canescens* and *G. clandestina*. Because of their resistance to cold and drought and their ability to thrive on low phosphate fertilising, these perennial species are expected to perform well in the Highveld areas.

2. Nursery studies

A large number of strains and cultivars of about 90 different cold weather pasture legume species were planted in nurseries for preliminary evaluation and multiplication of the seed. *Medicago truncatula*, with about 100 entries, was the best represented.

Most of these crops will probably do best in the winter rainfall area and will consequently be released in the Winter Rainfall Region.

3. Annual cold weather crops for the Highveld areas

The exceptionally low nutritional value of the natural grazing of the Highveld during winter could be considerably improved by planting suitable legumes. Unfortunately the choice of perennial legumes that are adapted in the Highveld is limited. Two field trials were therefore started. The object is to test a number of annual cold weather legumes that may be able to utilise the comparatively favourable autumn conditions of the Highveld effectively. The crops tested included several that easily formed seed before the winter, namely two *Medicago truncatula* cultivars and an early field pea *Pisum sativum arvense*. It also became evident that serradella *Ornithopus sativus* could grow until well into winter because its deep root system is able to utilise soil moisture well.

4. Annual pasture legumes and cover crops in vineyards

The evaluation of a number of annual winter pasture legumes as cover crops in vineyards was started in co-operation with the OVRI and the Faculty of Agriculture of the University of Stellenbosch. These crops have to comply with the following requirements:

- Good seed production and dormant seed for annual re-establishment;
- a very short growing cycle in order not to compete with the vines for soil moisture;
- good nitrogen-fixing properties; and
- a growth habit that contributes to the suppression of summer weeds.

Preliminary observations indicate that certain species, particularly *Trifolium subterraneum*, *Vicia angustifolia* and *Medicago truncatula*, are very promising for this purpose, even in the dry areas at Worcester and Robertson. The use of these crops, together with suitable weedkillers, is likely to result in a decided saving on cultivation and fertilising costs.

5. Suitable pasture legumes for cold winter rainfall areas

There is a need for pasture legumes for cold winter rainfall areas such as the Koue Bokkeveld and the Langkloof. Twenty annual species were tested in a preliminary trial in the Koue Bokkeveld during the year under review. A number of species appear promising and warrant further testing.

6. Optimum harvesting time for lupins *L. angustifolius*

Since local cultivars of *L. angustifolius* are not resistant to shattering, considerable damage is often done because large quantities of seed shatter before harvesting. In a field trial at Elsenburg harvesting was carried out at fixed times, before the normal harvesting time, and the effect of earlier harvesting on the germinative energy of the seed investigated. It was found that lupins can be harvested 14 days before the normal time without any adverse effect on the germinative energy. In practice this would mean that lupins can be cut off while all the pods are still relatively green. When the pods have dried they can be picked up with very little loss and threshed with the aid of a combine.

Artificial pastures

The high priority artificial pastures, chiefly legumes, enjoy in the Department at present has resulted in special attention being given to inoculants for pasture legumes. In addition to commercial inoculants, which were again of outstanding quality over the past year, inoculants for 46 other legumes for which no inoculant is available and which were planted on an experimental scale by farmers and other bodies were made available by the Plant Protection Research Institute. Several new *Rhizobium* strains

were also isolated locally or obtained from overseas. As a result the large number of new legume species considered promising at present can be properly inoculated for purposes of evaluation.

The increase in the planting of pasture legumes is reflected in an increase of 25% over the past year in the sales of inoculants for annual *Medicago* spp. and lucerne, and an increase of 137% in the sales of inoculant for *Trifolium* spp.

Over the past year it was shown that free-living nitrogen-fixing bacteria found in grasses in tropical areas also occur in South Africa. They have already been isolated from the roots of several grasses used in pastures. These bacteria are undergoing further investigation to determine how important they are.

Fodder and forage crops

The epidemic incidence of powdery mildew *Erysiphe* sp. in lupins *Lupinus angustifolius* since

1972 has been a serious blow to the cultivation of this crop. As it will take a long time before resistant cultivars are available, it will be necessary to rely on alternative legumes in the meantime.

During the year under review seed of the following promising species was received from Australia:

Vicia faba (100 strains);

Vicia narbonensis (1 strain);

Vicia sativa (1 strain);

Pisum sativum arvense (6 strains);

Cicer arietinum (2 strains);

Lathyrus ochrus (1 strain);

Lathyrus sativus (1 strain).

These crops are being multiplied at present and some seem very promising.

The multiplication of three sweet *Lupinus albus* cultivars, viz Ultra, Kiev and Neuland, was started. Unlike *L. angustifolius* these species have considerable resistance to powdery mildew and thrive on the heavier soils of the Western Cape.

III. Animal Production Improvement

LIVESTOCK PRODUCTION RESEARCH

BEEF CATTLE

Management and production systems

The extensive production of beef on natural grazing in the sourish mixed Bushveld has been investigated over the past nine years on the Soutpan Experimental Farm in accordance with the principles of controlled selective grazing and improved herd management. Calving percentages rose very sharply from an average of 56% to 86%, and weaning masses increased from 144 to 192 kg. This contributed to the increase in the production of meat (live mass) from 17,9 to 30,5 kg/ha over the past seven years and the increase in the mass turnover from 17% to 40%, despite the fact that the average number of large stock units/ha dropped by as much as 23% in some years.

Research in South-West Africa underlined the value of improved management practices. It was found that the average calving percentage of about 65% maintained by farmers can be readily boosted to between 80 and 90 per cent by applying the correct management practices. The most important factors requiring attention in this connection include the correct mating times, strategic supplementation and/or licks and the earlier mating of well-grown heifers. The results of a project carried out at the Sandveld Research Station showed a slight advantage in conception with winter mating (90%) as against summer mating (84,3%). Winter calves also grew slightly better than summer calves, with weaning masses of 218 kg as against 205 kg. The same trend was evident in respect of marketing. Winter oxen were market ready at two years, whereas summer oxen reached the same stage only at two-and-a-half years.

At the Uitkomst Research Station in South-West Africa, which is an example of a relatively sour grazing area, the natural grazing improved to such an extent with better management practices that weaning masses increased from 175 kg to 280 kg over the past few years. The practice of finishing oxen intensively or on the veld with maize silage and concentrate supplementation and then marketing them at two years appears to be undesirable because the carcasses it produces are too heavy. A better

proposition, which is being investigated at present, is intensive finishing on *Cenchrus ciliaris* grazing or *Cenchrus* hay as roughage.

Production systems are also being carefully investigated in Natal. The matters investigated included the stocking rate and energy supplementation from October to the middle of January on highland sourveld. The cow-and-calf unit was taken as the criterion. The respective stocking rates were 0,6 and 0,9 of a cow-and-calf unit per ha. The mass increases of calves did not differ significantly for the two stocking rates. The cows at the lower stocking rate initially gained slightly more mass than the cows on the higher stocking rate, but differences later disappeared. Energy supplementation to the calves produced no significant improvement in growth. Neither did it lead to changes in mass in the cows.

In a similar trial on kikuyu grazing where dual-purpose breeds and British beef breeds were used, it was established that the mass increase of the calves was not affected by type or stocking rate. On average about 44% more weaning mass was produced with the higher rate (6,5 cow-and-calf units per ha) than with the lower rate of 4,5 cow-and-calf units per ha.

Kikuyu appeared to have a great deal of potential for beef production in the Natal mist belt and on highland sourveld. At the Tabamhlope Research Station a daily mass increase of about 0,7 kg can be maintained throughout the year with steers, provided a low stocking rate is applied. In this way about 600 kg per ha can be produced. With a stocking rate of 2,5 cow-and-calf units per ha it was found that the calves grew at an average rate of 0,9 kg per day up to weaning, which meant that about 500 kg per ha was produced on kikuyu.

At Cedara, where the inclusion of kikuyu in production systems is being more extensively investigated, it appeared that the maximum mass increase per ha of about 700 kg can be attained if a stocking rate of 7 to 8 cow-and-calf units is applied.

In the Eastern Cape Region the inclusion of *Eragrostis curvula* grazing in production systems is still yielding promising results. Energy supplementations of about 25% of total requirements appeared to be the most favourable in respect of growth capacity and grading. At this level 350 kg of meat per ha was produced. If this figure is increased, no improvement results, probably because of the fact that the animals start concentrating on the energy supplements at the expense of the relatively less palatable grazing.

The *Döhne Research Station* is also concentrating on testing licks. An important factor determining the calving percentage in the sourveld area is the excessive loss of mass of cows during winter and during the lactation anoestrus period. The ordinary urea licks do not appear to be adequate. The use of laying-hen manure was therefore investigated. This produced promising results. The cows ate 2,3 to 3,2 kg of laying-hen manure a day, and the average loss of body mass was lower than with the control group, which received the urea energy lick. In addition the calving percentage was 16 per cent higher for the group receiving the laying-hen manure.

Fertilisation of the veld is being investigated in the Highveld Region. In a trial where fertilised veld was compared with unfertilised veld of the *ymbopogon-Themeda* type, it was found that fertilised veld is able to carry twice as much stock as unfertilised veld without high mass increase being forfeited. Meat production per ha is therefore practically doubled.

In the Winter Rainfall Region beef cattle play a less important part in the farming pattern. Research here is geared mainly to comparisons between beef production and other branches of farming. At Nortier the Simmentaler herd is being used to determine the effect of the ruminant on the natural veld cover. The results of these trials are also being used, as far as possible, to compare the incomes from the various livestock enterprises.

Evaluation and measurement of performance

Various bull breeds are being evaluated at the Vaalharts Research Station for purposes of cross-breeding. Africander, Brahman, Charolais, Hereford and Simmentaler bulls are being used with Africander cows. It is clear from the performance of the progeny of these breeds with various treatments that the production of certain cross-bred Africanders could do a great deal to boost the efficiency of beef production. The combination of various breeds with the Africander, however, not universally successful, since there is an interaction between the sire breed and the production system (intensive or extensive) and between the sire breed and the production function (slaughter animal or female breeding animal). For instance, Brahman and Simmentaler crosses are both suitable as slaughter animals and female breeding animals, but only make good slaughter animals under an extensive production system. The biggest advantage of the cross-bred Herefords is their performance as slaughter animals, but they do better under an intensive or semi-intensive production system. Charolais x Africander crosses appear to have no merits under normal extensive cattle-farming conditions because the risk of calving problems is too great. As a slaughter animal this cross does very well, especially with intensive fattening.

It has become necessary to find a suitable direct criterion for body composition, especially

protein and fat, for beef cattle. This is especially necessary in the performance testing of bulls, where an estimate of the body composition is necessarily an advantage in the total evaluation programme.

The so-called urea and tritium dilution techniques appear to have possibilities and are being tested at present at the Animal and Dairy Science Research Institute with the aid of bulls of the Africander, Bonsmara, Charolais, Friesland x Africander and Hereford breeds. Prediction ratios between the urea or tritium space and the components of body composition are being drawn up at present. The preliminary results show that the ratios are sufficiently accurate to predict protein and fat fairly reliably, *provided* urea or tritium space is determined at intervals and calculations are not based on one or two determinations only.

The performance of bulls at performance testing centres is measured under standardised conditions and with a high concentrate ration. Many of the bulls tested come from veld conditions where the nutritional value is often low. The question arises whether bulls that are "accustomed" to veld conditions can be tested on concentrates. This question is being investigated at the Animal and Dairy Science Research Institute with bulls of the Africander, Hereford and Simmentaler breeds, and with both a concentrate and a roughage ration. The purpose is to determine how the three breeds compare in respect of criteria of efficiency on both rations. The data from birth to eight months show no interaction between breed and ration, but the period is probably too short for reliable conclusions to be drawn.

Reproduction

Various aspects of the *post partum* period and the synchronisation of oestrus in the Africander were investigated. This work is being undertaken in the Free State Region. In respect of the length of the *post partum* anoestrus phase and conception, early weaning yielded better results than energy supplementation to the cow. The application of progesterone treatment was also successful in breaking anoestrus.

Although oestrus synchronisation was satisfactory, the conception during the oestrus period was generally low - 20 to 35%. Better results were occasionally obtained but most synchronisation techniques still do not produce such satisfactory results that they can be recommended as a general practice.

Hormone analyses of blood during the *prepartum* and *post partum* phases and during normal and synchronised oestrus periods produced a far clearer picture of the animal's hormone status. The technique of hormone analysis is a promising aid in identifying reproduction problems.

The investigation into the process of uterus involution indicates that the uterus of the Africander does not fully recover before 32 to 36 days *post partum*. It was also found that the *corpus luteum* of pregnancy degenerates rapidly after birth, both morphologically and physiologically, and



The Beef Bull Testing Centre near Queenstown

therefore does not contribute to the relatively long *post partum* anoestrus phase of this breed.

Feeding

In the Highveld Region continual attention is given to economical methods of finishing beef cattle. For instance, the inclusion of high percentages of silage in finishing rations is being investigated. Silage rations together with a protein supplement appear to show a profit of R97 over feed costs, which is considerably better than the R44 for high concentrate rations.

Profit over and above feed costs on concentrate rations can be raised from R44 to R64, at current prices, by replacing maize meal with whole grain and so eliminating the milling process.

An observation trial is being carried out on regulating the intake of concentrates with the aid of salt, so that a daily mass increase of 0,8 kg can be obtained with heifers from weaning to covering age. In the case of pregnant Simmentaler heifers 20% salt had to be mixed with the protein supplement in order to restrict the intake to 1% of the body mass, but the same intake was obtained with Africander heifers with 13% salt. For Africander cows about 8% salt had to be mixed with the protein supplement to restrict their intake to 1,5% of body mass. The experiment is continuing.

MUTTON SHEEP AND GOATS

Considerable information on the production potential of Boer goats was obtained at the *Adelaide Experimental Farm* (Eastern Cape Region). The average lambing percentage of the flock at the Adelaide Experimental Farm was 187,

with a weaning percentage of 143. The growth rate of the lambs from birth to slaughter at 150 days was about 170 g per day. The average live mass at slaughter was 38,7 kg. It was estimated that where cattle and goats are run simultaneously 28,4 kg of meat per ha can be produced (cattle 17,6 kg and goats 10,8 kg of meat/ha).

Former consignments of frozen Boer goat semen sent abroad from the *Animal and Dairy Science Research Institute* at Irene produced fairly satisfactory results. In view of sustained interest abroad investigations to find more suitable diluents and techniques are being continued. It was found that moderate centrifugation of the semen and the removal of the seminal plasma prior to freezing greatly increased the survival rate of the sperm. The same effect is obtained by washing the semen with a buffer solution beforehand and then using only the concentrated precipitate after centrifugation. A further advantage is that a higher concentration of cells per volume can be obtained in the insemination dose, which promotes better fertilisation results.

In a slaughter lamb production trial at *Outeniqua* the average lambing and weaning percentages were 115 and 101% respectively. Where the lambs were slaughtered at five months, the average carcase mass was 15 kg and 90,6% of the carcasses were graded "super". Where the lambs were slaughtered at four months only 27% were graded "super", chiefly because of a very low fat content.

At Elsenburg the effect of over-feeding the ewes during the last third of pregnancy on the high mortality figure (19%) among SA Mutton Merino lambs was investigated. The results showed that

over-feeding at this stage is not an important problem. Observations during the trial indicate that underfeeding of pregnant ewes, insufficient clostrum, poor shelter and a lack of attention during birth are the major causes of a high mortality figure among lambs.

Good progress has already been made with the development of a white-woolled mutton sheep at the Carnarvon Research Station in the Karoo region. Of the various crossings tested, 50% SA Mutton Merino x 25% Ronderib-Africander x 25% Merino proved to be the closest to the ideal. This crossing showed the best weaning mass and mass at 2 months. In addition the group had a lambing percentage of 102 and a weaning percentage of 92. The wool was free from kemp. All other crossings were eliminated and in future only this crossing will be used for the further development of a white-woolled mutton sheep.

The inclusion of maize silage in finishing rations for lambs at Potchefstroom appears to be successful. Satisfactory growth results (about 15 g/day increase) were obtained with rations consisting of 70% silage, 20 to 25% whole maize and 5 to 10% crude protein supplement.

PIGS

Feeding

The use of high-lysine (opaque 2) maize as a substitute for ordinary maize and as a protein extender in pig rations was investigated at Irene. Projects on breeding, planting and developing high-lysine maize are under way in South Africa.

The replacement of ordinary maize with high-lysine maize in a pig growth ration with a suboptimum protein content (14%) produced 8 to 10% faster growth and 7 to 8% better feed utilisation. It was also established that the quantity of fish meal in the ration can be reduced by 22% without impairing the performance of the pig, provided high-lysine maize is used instead of ordinary maize. This investigation therefore showed that high-lysine maize not only has production advantages for the pig farmer but also results in a considerable saving on protein, which could help relieve the threatened protein shortage in South Africa.

A study was undertaken in the course of which the effect of ration energy concentration on the growth rate, body composition, carcass quality and efficiency of feed and energy utilisation of *ad libitum*-fed pigs was investigated. Preliminary results show that a reduction of up to 8% in the energy concentration does not impair the growth rate, since the pig compensates by eating more. The pig's ability to eat larger quantities is limited, however, and further dilution therefore reduces the growth rate. The efficiency of energy utilisation for mass increase drops gradually as the concentration of ration energy decreases. On the other hand the efficiency with which air-dried feed is utilised drops rapidly. The effect of the energy concentration in the ration on the body composition and carcass quality of the growing pig - decisive factors in

determining practical ration energy levels - are being studied.

A trial was designed to determine whether the fact that feed is wet or dry can make any difference to carcass quality and the efficiency of energy utilisation. A digestion study has so far revealed no differences between wet and dry feeds in respect of protein and energy digestibility.

A pilot trial was carried out at Elsenburg to determine whether fish silage can be used in pig rations. Satisfactory intakes were obtained. It was also found that about a third of the protein in pig growth meal can consist of fish silage.

The possible use of apple pulp in pig rations was also investigated. The study showed, however, that apple pulp has little value for pigs.

Promotion of production

There is still a crying need for extension, especially on feeding, management and housing. Over the past year extension played a prominent part at both Irene and Elsenburg. The annual short course at Elsenburg was attended by 160 people, and the attendance figure for the pig day at Irene was 100. Over 200 prospective and established pig farmers visited the research unit at Irene.

MEAT SCIENCE

Carcass grading

At the request of the South African meat industry the Animal and Dairy Science Research Institute started a comprehensive investigation into the carcass grading system for cattle.

The most important criteria according to which carcasses are graded are the sex and age of the animal from which the carcass came and the conformation and fat covering of the carcass. Age is determined by the number of permanent incisors: 0 to 2 teeth are indicated as age group A, 3 to 6 teeth as B and 7 to 8 teeth as C. A specific combination of the sex, age, conformation and fat covering then determines the grade allocated to a carcass. The present grades for beef carcasses are Super (only A), Prime A, Prime B, 1A, 1B, 1C and 2, 3 and 4 (which includes the age groups A, B and C).

A survey of 1 542 beef carcasses of all grades revealed that the grading regulations in which the carcass properties of the various grades are described are accurately applied by the meat graders. This conclusion was reached because it was found that carcasses of the higher grades (Super, Prime 1) had a higher average carcass mass, more compact conformation and more complete fat covering than carcasses of the lower grades (2,3,4).

A comparison of the carcass properties of the grades allotted on various days showed that the criteria used for grading are fairly consistent from day to day.

Considerable variation in the individual carcass properties was found within grades. The coefficients of variation for carcass conformation within the Super, Prime A and B, 1A, 1B and 1C grades lay between 12,4 and 16%. However, within

Properties of beef carcasses of the various grades, derived from animals from three age groups

	Carcass mass (kg)				*Fat thickness (mm)		
	Age group				Age group		
	A	A	B	C	A	B	C
Super	204,5	-	-	-	3,8	-	-
Prime	189,8	255,5	-	-	3,2	3,8	-
1	177,7	229,6	274,1	2,7	3,3	4,2	
2	164,9	205,9	205,9	2,1	2,4	3,4	
3	121,0	206,2	223,0	0,9	1,5	1,5	
4	87,7	158,8	144,7	0,3	0,0	0,0	

* Measured over the *M. longissimus thoracis* - 10th rib

grades 2, 3 and 4 the coefficients of variation for conformation lay between 23,3 and 33,5%. When carcasses in the latter three grades were grouped according to age the coefficients of variation for conformation were only between 7,6 and 29,8 per cent. The same trends were observed in respect of the variation in the fat cover of carcasses within the age groups of the various grades.

Refrigeration of carcasses

A far-reaching investigation by the Animal and Dairy Science Research Institute, in co-operation with the Veterinary Research Institute and the CSIR, has already produced unequivocal guidelines in accordance with which beef carcasses should be refrigerated in order to prevent the meat from toughening as a result of cold shortening of the muscles immediately after slaughter. According to a panel of tasters and also according to the physical values for toughness of meat, cold shortening can be prevented by refrigerating the smaller beef carcasses (150 kg and under) at 7 °C for the first 10 hours after slaughtering. Larger carcasses can be refrigerated at temperatures as low as 3 °C during this period. In both cases the air velocity should be 0,75 metres per second. With these refrigeration conditions the temperature of the back muscles (*M. longissimus lumborum et thoracis*) did not drop below 9 °C within the first 10 hours after death, so that toughening was prevented. It was also found that carcasses hung from the pelvis through the *obturator foramen* did not show toughening of the muscles even at a refrigeration temperature as low as 0 °C. The accompanying figure shows the physical shear force of the muscles of carcasses hung in the conventional way, as against that of carcasses hung by the pelvis. This method of hanging was so effective in preventing cold shortening that the muscles of such carcasses were as soft two days after death as the muscles of conventionally hung carcasses aged for seven days. Sarcomere counts of the muscle fibres were also carried out on the muscles of carcasses hung in the various ways. The criterion is that the more sarcomeres (microscopic muscle contractile unites) there were per unit of length the more

contact there was between the muscle proteins actin and myosin, enabling them to form cross-links, and the tougher the meat. The converse is also true.

The muscles of the carcasses that had hung by the shins had considerably higher sarcomere counts than those hung by the pelvis and the meat of carcasses hung by the pelvis was considerably more tender. Larger carcasses also had lower counts than smaller ones and counts decreased consistently as the temperatures at which the carcasses were refrigerated rose from 0 °C to 7 °C.

Meat and leather quality

The carcass and meat qualities of young Africander cross-bred oxen which grew at three different rates were determined, in addition to the quality of the hides from these animals and the leather made from the hides. The Leather Research Institute carried out this experiment in co-operation with the Animal and Dairy Science Research Institute. It was found, as in previous investigations of this nature, that the hides that produced the lowest salted yield in respect of the unsalted hide also had the highest tearing resistance and tensile strength in the leather, which indicates a higher degree of cross-linkage in the collagen of the stronger leather.

It was also notable that the meat derived from the slowest-growing animals was the toughest and that such animals produced the lowest salted hide yield as well as the best quality of leather. Low soluble collagen in the hide and muscles appears to occur simultaneously with the same higher physical resistance in both products, viz leather and meat, with opposite effects on quality.

Meat microbiology

An investigation of the microbiological quality of South African dried sausage bought at various butcheries revealed that 23% of the specimens contained *Salmonella* and that *Microbacterium thermosphactum* was present in 37%. The water activity ranged from 0,40 to 0,89 and the pH from 4,61 to 7,09. Standards for water activity and the presence of pathogenic micro-organisms should therefore be laid down for this product, which evidently varies greatly in quality.

WOOLLED SHEEP

Wool analyses of Merino sheep in the Karoo Region show that a large percentage of the clip is severely and deeply weathered. This means that much of the length of the wool goes to waste in the form of noils and there are also other disadvantages. This shows that there is still a great deal of room for improvement: management could be improved by adapting shearing times to the weather conditions and providing shade in the camps and by selecting for better density, staple formation and fluid wool oil.

A study of the selective grazing habits of sheep in comparison with those of cattle on Karoo grazing produced interesting results. Grazing

specimens taken with the aid of cattle with oesophageal fistulas contained an average of 8.4% less digestible organic matter than those taken from sheep. Specimens taken from fistulated sheep during July contained 47% digestible organic matter and those taken in February 71% digestible organic matter. The crude protein values of the cattle specimens were 4.2% lower than those taken from sheep, with the highest values during February (cattle - 9.5%, sheep - 14.7%) and the lowest during July (cattle - 7.3%, sheep - 9.2%).

The voluntary intake and digestibility of the most promising saltbush species, viz *Altriplex nummularia*, *A. canescens* and *A. lentiformis*, were investigated. The sheep ate considerable quantities of the stems of the plants together with the leaves. The material eaten was fairly rich in crude fibre with a relatively low digestibility. The intake of the sheep was just about adequate for maintenance feeding in each case.

In the *Eastern Cape Region* the application of 60 kg of limestone ammonium nitrate per ha during February increased the yield of dry matter in natural sourish grassveld by 34% to 70%, within six weeks. The crude protein content was increased by 50% at the same time, i.e. from 4 to 6% crude protein.

When lucerne was introduced into the sourveld it constituted 30% of the dry matter yield. This raised the crude protein content of the veld grass by 2%. However, because lucerne loses a high proportion of its leaves from May to the early winter it is a poor component.

Cutting sourveld in February had no noticeable effect on veld production. Where sourveld was fertilised supplementation by means of a protein lick led to better mass increases in lambs than where no fertiliser was applied. The accompanying table shows the effect of a low and high energy lick on fertilised and unfertilised veld.

Mass increases of lambs where wet ewes were fed two different licks on fertilised and unfertilised veld (g/day)

	High protein lick (35%)	Low protein lick (15%)
Unfertilised veld	150	102
Fertilised veld	192	153

At the Animal and Dairy Science Institute at *Irene* the wool production potential of certain woolled breeds and their crossings was investigated by means of a microscopic examination of the skin. A survey of the proportion of secondary to primary fibres (S/P ratio) is being carried out. This proportion, together with the follicle and fibre sizes, can give an indication of a particular animal's potential for wool production. Observations so far show that the Merino has a decided advantage with regard to the S/P ratio over certain other breeds. The following table reflects this.

Sheep breed	Merino	Merino-land sheep	Finnish Landrace	Dorset Horn	Border Leicester
S/P ratio	24	10	7	7	4



Merino wethers with oesophageal fistulas used in a trial to determine voluntary intake, digestability and chemical composition of Karoo veld as it is selected by small stock

PELT SHEEP

The purpose of short scrotum castration of rams is two-fold, namely to retain the growth potential of the animal and to use these castrates as teasers. The technique is simple, consisting merely of the shortening of the scrotum of young ram lambs with the aid of rubber bands. The testes are pressed against the abdominal wall and the scrotum tied off underneath. In an experiment with ram, short-scrotum and wether Karakul lambs it was found that the first two types did not differ in respect of growth capacity and that both ram and short-scrotum lambs were superior to the wethers. Short-scrotum lambs show atrophy of the testes, reduced spermatogenesis and poorer quality semen, but retain their normal libido and mating abilities. The quality of the mutton of the lambs is comparable to that of rams and only slightly poorer than that of wethers. Problems with regard to the regrowth of the scrotal sac and consequent development of normal testes are being investigated.

To promote conception in ewes a hormone release factor was used to synchronise ovulation instead of the hormone itself. Karakul ewes were treated with LH release factor (LH-RH) at various stages of the oestrus cycle. More ewes were on heat with LH-RH on the 12th than on the 14th and 16th day of the cycle, but their lambing percentage was poorer. Reasonable synchronisation was obtained only with the last two groups. On the other hand these groups had problems with silent heat; this matter is being investigated.

The project at the Kalahari Research Station, where various mating seasons are being tested with and without flushing, indicates on the one hand that the effect of supplementary feeding on the reproduction of Karakul ewes is insignificant and on the other hand that excellent results can be obtained with good management. Lambing percentages of about 150% or even more are still being obtained with all the treatments. It is evident that the goal in the Kalahari sandveld, and indeed in the rest of the Karakul area as well, should be three lambs every two years.

The response of the lactating Karakul ewe to hormone treatment was investigated. Data were collected on the lambing percentage after artificial insemination of hormone-treated ewes outside the breeding season.

According to the results the percentage of ewes that go on heat and lambs born increases as the interval between partus and hormone treatment increases. Higher lambing and heat percentages were obtained with ewes that had received a higher dose of pregnant mare serum hormone, and higher lambing percentages were obtained from non-lactating than from lactating hormone-treated ewes.

The effect of flushing during the active breeding season on the fecundity of Karakul ewes was investigated. It is evident from the results that flushing has a varying effect on fecundity and that

a general increase in fecundity cannot be expected with flushing during the breeding season.

A comparative study in which the effectiveness of two methods of synchronisation, namely intravaginal sponges and subcutaneous silicone rubber implants, was investigated with Karakul ewes outside the breeding season revealed that the period between the withdrawal of progesterone and the start of oestrus (effectiveness of synchronisation) and the distribution of oestrus are considerably shorter in the case of the implant. No difference in the ovulation rate was found. The implant would therefore appear to be a more effective method of synchronisation.

A project in which the annual progress with breeding was measured for the most important pelt qualities in Karakul lambs, namely curl type, pattern, hair quality and hair length, has reached an advanced stage. The best response to selection appears to have been obtained for decrease in curl development. The average response to selection over three generations for decrease in curl development was 39% during the past year, and average responses of 30%, 19% and 13% were obtained for improvement in pattern, hair quality and hair length, respectively.

The development of a specific chocolate brown Karakul pelt with light hair tips (gold and silver) has already reached the stage where important trends are evident. It is also clear from the project that the economic value of a pelt depends mainly on the occurrence of light hair tips. The correlations found between the colour components also show that the quality of a brown pelt is determined rather by the light tips than by the intensity of the brown colour.

The average price of brown pelts rose sharply this year. The pelts marketed on the November 1975 auction fetched an average price of R13,83, whereas the corresponding price in November 1976 was R22,85. The latter price was 10,6% higher than the market average from brown pelts. Although brown pelts fetched very good prices for the better grades, there was notably less interest in the poorer qualities.

The development of other colours in Karakul is progressing satisfactorily. The following aspects are of importance:

- (a) In the case of breeding for the grey colour, hair quality is still improving and it appears to be possible to manipulate shades by means of carefully calculated mating. The problem of a sub-lethal factor is still receiving attention and one dominant grey ram has been successfully kept alive on a liquid ration. A few lambs have been obtained from this ram.
- (b) Good quality seems to be possible in the case of the recessive white, but pattern and hair length are still presenting problems. This is as expected, because research shows that white hair is longer, less elastic and finer than black hair fibre.

The metallic lustre that goes with thick hair is becoming more and more pronounced and is

apparently affecting the serviceability of the garments produced. The project consists basically of two-way selection, with simultaneous selection for the M line and against the G line (metallic appearance). The most important findings are the following:

- a) The pattern deteriorates in the M line from the second to the third generation, whereas there is a slight improvement in the G line.
- b) The hair quality is better throughout in the G line.
- c) The M line has thicker hair than the G line.
- d) The metallic lustre consistently occurs more in the M line than in the G line. A slight decrease was evident in the G line.
- e) There is still a visible tendency for pelt characters to deteriorate as the metallic lustre increases.

Morphological studies on the hair fibre and on physical friction resistance tests will be included in the project.

In practice one often finds that certain types of Karakul lambs (especially the feathery and rippled types) which in practice are undesirable from the point of view of breeding photograph very well and are marked up too high and mistakenly bought as desirable breeding material. Preliminary observations strongly indicate an interaction between wave breadth (S breadth), ripple breadth (interwave breadth) and hair length. In co-operation with the Karakul Board and the Karakul Breeders' Society a number of pelts of desirable and deviant types have been collected and the phenotypes have been judged. The material is being subjected to a histological examination at present.

The natural method of curing and drying of pelts sometimes causes problems as a result of a microclimate in the drying rooms that causes the relative humidity to rise too high. Preliminary observations on the time and effectiveness of drying indicate an interaction between humidity, temperature and ventilation. Hot, humid conditions result in slow drying, which causes follicle rot and falling of hair during curing. The Division of Agricultural Engineering has planned a prototype drier which they intend to use in trials to monitor the effect of certain variables on drying.

A project in which dry curing and washing were investigated as methods of preparation for the market showed that dry curing does not affect pelt quality, the quality of the leather or the economic value of the pelt.

Dry curing is therefore a good option when preparing pelts for the market, especially during humid conditions.

ANGORAS

An investigation into the effect of the level of energy and protein feeding on perinatal losses, lactation and growth of Angora lambs showed that both energy and protein supplementation resulted in highly significant differences in most cases. There were obvious differences in body weight at the end of pregnancy, milk production, udder size, duration

of pregnancy and the concentration of protein and fat in the milk. The crude hair weight and the growth capacity of the lambs were also significantly affected.

Research on the abortion problem was continued during the year under review. The thyroxine levels of pregnant ewes that had received high and low feeding levels were determined in order to investigate the response of hormones that play a direct part in metabolism. According to the results thyroid function plays a subordinate part in the metabolic adjustments under conditions of nutritional stress. The possibility of thyroid disfunction as a factor in the absorption problem was excluded by the results of this research.

Initial results of an investigation into the effects of cold on the underlying causes of abortion indicate that intense cold stress of short duration probably does not have much effect. According to the results, however, deaths in such conditions follow a marked drop in blood glucose concentration and body temperature, with the hormone cortisol, which is secreted by the adrenals, showing a sharp increase.

All the animals that collapsed from cold stress during the trial recovered within about five hours after glucose had been administered intravenously. This investigation is continuing.

Since a number of Angora goats with a low carcase grading are marketed, the possibility of finishing these animals economically is being investigated. The same fattening rations are used for this purpose as are recommended for sheep at present. Although the trial is still in progress and the results have not yet been processed, it would appear that Angora goats respond well to fattening.

A selection trial against poor reproduction and for high clean hair mass in rams, the aim of which is to build up an outstanding breeding group, is still showing an improvement in fertility and hair mass. The animals in this project were transferred to the Jansenville Experimental Station where the project will be carried out in the natural habitat of the Angora goat.

DAIRY CATTLE

Milking

Officers of the Animal and Dairy Science Research Institute carried out a survey on milking techniques and lactation-physiological aspects with 115 herds in the Transvaal and Free State Regions.

In the Transvaal Region 7377 cows from 80 herds were examined and the average percentage of mastitis-infected cows (clinical and sub-clinical mastitis) was found to be 41,3%, with 4,55% and 80% as the lowest and highest values.

The percentage of damaged quarters in herds varied from nought to 13,16%, the average being 3,88%. The following defects that could contribute to udder and teat damage were found in milking machine parts:

Broken short milk tubes	17,2%
Broken short pulsator tubes	26,4%
Defective pulsators	12,0%
Inefficient vacuum control valves	34,8%

In 82,8% of the dairies the teat cups are removed from the cows' udders in a way that could lead to udder damage. The average overmilking time was 50,6 seconds, which is also harmful to udder health. Although teat dipping is practiced at 55% of the dairies, it is only efficiently applied at 17,5%.

Feeding

At Döhne *Eragrostis curvula* was investigated as a source of roughage in complete dairy rations. Results show that the dry matter intake and milk production increase as concentrates in the ration are increased from 30% to 70%.

An investigation at the Animal and Dairy Science Research Institute in which maize meal was replaced by maize straw at various levels and various degrees of fineness in the rations of milk cows showed the following: The milk cows are able to maintain a milk production of between 15,5 and 18,3 kg per day, depending on the roughage:concentrate ratio and the degree of fineness of the roughage. Dry matter intake was systematically increased to 46% as concentrates in the ration increased from 35% to 65% and the roughage was made finer, the mesh size being decreased from 19 to 6 mm. Each combination of roughage:concentrate ratio and mesh size produced a different level of *ad libitum* intake and a different milk production. The combination of roughage:concentrate ratio and mesh size did not have a significant effect on the general digestibility of the ration, nor did it have a marked effect on the milk composition.

Extension to the industry

Officers of the Animal and Dairy Science Research Institute officiated at 12 dairy farmers' days and two symposia. One short course was presented in co-operation with the Transvaal Region and another in co-operation with Nestlé, at Malmesbury. Thirty-three lectures were held at these meetings. Seventy-four visits were paid to farms. Twelve pamphlets on breeding and feeding dairy cattle were submitted for publication.

POULTRY

Feeding

The feeding trials carried out were aimed chiefly at finding means of reducing feed costs, which constitute about 70% of total production costs. A great deal of research aimed at saving on protein, especially fish-meal, has already been done or is in progress. For instance, it has been shown that laying rations containing as little as 5% fish-meal produce good results. It has also been shown that it is possible, using the feed constituents available at present, to compose laying rations containing 14% protein instead of the required minimum of 15% without impairing egg

production, egg size or feed conversion. A reduction of one per cent in the protein level means an annual saving for the country of 4 902 tons of protein. In the case of broilers it has also been shown that rations containing far less protein can be used without any visible decrease in the growth rate.

Breeding

Breeding for the characters that affect egg production is carried out chiefly at Potchefstroom and Glen. The important characters to which attention is being given include egg number, colour of the egg shell, quality and mortality. Feather colour also plays an important part, because it is used in sexing day-old chicks. If the services of sexers could be eliminated the saving would be considerable.

The breeding of laying hens is also progressing well. During the 1975-77 test at Glen a Departmental White Leghorn cross achieved the highest egg production. A brown egg cross from Potchefstroom is being tested at present. The Potchefstroom Koekoek, which was developed at the Potchefstroom College of Agriculture, has been recognised as a new breed by the South African Poultry Association.

DAIRYING

Review

Surpluses or shortages of dairy products are by no means unusual. Long-term projections point to future shortages and after a series of good seasons it is only realistic to expect drought again. South Africa has the potential, however, to produce sufficient dairy produce of all types for its own consumption. Because the dairy industry is really geared to local consumption and the weather conditions are frequently not conducive to stable production, the industry should concentrate on producing products of the highest quality with a long shelf life so that they can be stored. This would greatly reduce the effects of the characteristic fluctuations in production on the steady supply of dairy products.

The purchasing of all milk on a quality basis would contribute greatly to the solution of the problem. The Animal and Dairy Science Research Institute has already put a pilot scheme into operation in the Western Cape to investigate the problems related to the introduction of a scheme for quality purchasing based on milk composition and hygienic quality. Factories were requested by the Dairy Board to start testing for bacteriological quality from 1 April 1977 onwards, as an information service to the producer. Prices are expected to be adjusted in accordance with this property from the beginning of 1978.

The raising of the quality standards for butter for the local market is being considered at present; this would bring them more or less into line with the requirements of overseas purchasers. The action of a few big purchasers of dairy products in South Africa in prescribing quality specifications for some



Examples of Grade I Gouda cheese made with a starter culture composed of bacterial isolates that were isolated and examined at the Animal and Dairy Science Research Institute

of the dairy products they market is welcomed because this, more than any control measures, could contribute to the improvement of the general quality of dairy products.

Milk

The presence of inhibitors in milk and the occurrence of heat instability were brought to the attention of the Institute repeatedly during the year. Heat instability causes problems mainly in the manufacture of UHT and condensed milk products. The Dairying Division is co-operating with work on methods of detecting and controlling inhibitors in milk, and methods of tracing heat instability in milk and determining its severity. Modifications and adjustments in the manufacturing techniques were recommended to ensure the stability of the final products, and have been successful.

The gas chromatographic method of determining the amino acid spectrum of milk and milk products has now been standardised. The natural amino acids, with the exception of tryptophane, can now be determined in a single process. Because more results can be obtained more rapidly and cheaply, the technique will make a big contribution to the investigation of improving the

nutritional value of milk through selection. In future it will also be easier to monitor the nutritional value of the various commercial milk products.

The quality of the various protein fractions in the milk of 114 cows was analysed over four periods of their lactation cycles and the results tabulated. As a percentage of the milk the total protein and protein fractions show a seasonal change, but the total protein constituents produced by the cow do not show this change.

The seasonal variations in the various fractions as a percentage of the total protein parallel those in the total protein. The total protein should therefore be a good criterion for measuring seasonal changes.

The effect of the omission of one or two milkings per week on the milk yield and composition was studied at the Animal and Dairy Science Research Institute because the milking of cows twice daily, seven days a week, places dairymen at a social disadvantage.

The results indicate that the weekly yield of milk does not change significantly. The content of total protein, casein and non-casein nitrogen increased significantly in the milk obtained after the

omission of one milking, while that of potassium and soluble phosphate decreased.

Free fatty acids in milk have become an important defect. This defect, generally called rancidity, is caused by the action of lipase secreted from the mammary gland, by changes in the composition of milk fat which make it more susceptible to lipolysis, by mechanical treatment, prolonged storage at low temperatures, and cooling followed by heating or by long periods of lactation.

Eighteen per cent of samples of market milk delivered in tankers contained free fatty acids in concentrations exceeding the perception of rancidity.

The installation of *samplers* on milk tankers is subject to the accuracy in which the sample reflects the quality of the bulk milk. Five such samplers were tested at the Institute and the carry-over effect was measured by alternating milk of high and low bacterial count. The carry-over effect appeared not to be very serious. Some of these species were able to survive a heat treatment of 10 seconds at 135 °C, and one even survived 30 minutes at 110 °C.

The keeping quality of sterilised and UHT-treated milk is limited by the number of heat-resistant spore-forming organisms present in the raw milk. A total of 220 bacteria were isolated from 169 samples of UHT milk and 148 samples of sterilised milk. 110 of these isolates were identified as spore-forming *Bacillus* species.

Butter

A successful manufacturing technique for cultured cream butter (aroma butter) under South African conditions was developed by the Dairy Technology Section and is now available for application by any creameries that may be interested and have the necessary equipment. Apart from the pleasant farm butter flavour of this product, its spreadability is almost one and a half times that of ordinary butter made from the same cream.

Cheese

Mould growth on cheese must be considered a potential hazard because many fungi are able to produce toxins. Forty-two samples of normal cheese, mouldy cheese and mould-ripened cheese (Gouda, Cheddar, Blue-veined and Camembert) manufactured in different parts of the country were analysed for mycotoxins in this respect.

It is gratifying to report that no indications were found that any of the cheeses contained toxins. Mould growth on cheese must, however, not only be considered an economic problem but also a potential health problem because the experiments established that of 46 mould isolates grown on sterilised maize and tested for toxicity to ducklings, 9 were highly toxic and 15 moderately toxic.

The *hydrolysis of lactose* presents interesting technological and economic opportunities for the cheese manufacturing industry. It has already been

possible to reduce the lengthy manufacturing process of Cheddar cheese by 25%. There are also strong indications that the cheese will ripen far more rapidly and be ready for marketing earlier.

Consumers are showing a keen interest in natural cheese with a low fat content. The manufacture of such cheese entails numerous technological problems which it has not yet been possible to solve. However, the Institute has made positive progress with the body and consistency problems and is at present undertaking studies of techniques in connection with flavour development.

Methods of manufacturing skim-milk cheese and exotic cheese varieties which have hitherto been imported were investigated for local application and demonstrated to interested persons. Over 3 000 tons of exotic cheese was imported in 1976, despite the overproduction of all ordinary dairy products in South Africa.

Trials with the manufacture of *cheese flakes* were highly successful and a product with an extremely attractive quality and excellent keeping quality was developed. Unlike ordinary cheese powder, which is used chiefly in other food industries, this product lends itself very well to direct household use. If the price can be kept relatively attractive, the product should do well in the retail trade.

Despite the fact that most high quality *cheese wax* is still imported, factories are experiencing serious problems with peeling of the wax during prolonged storage. An investigation of the problem led to new recommendations for cheese wax, which may in future be manufactured locally by the petrochemical industry.

The use of green cheese or barrel cheese is increasing all the time in the *processed cheese industry*. It has great advantages in that handling, storage and packing costs can be reduced considerably. The Institute has succeeded, by this principle and using skim-milk, in making a processed curd cheese with a very low fat content but a good flavour and texture.

During the past year the *Quality Improvement Laboratory* paid more attention to the quality of cheese, from both the chemical and the bacteriological point of view. Special attention was given to a few factories that suffered very big losses as a result of quality problems. The problems were solved and cheese of a very high quality is being manufactured at present. Large quantities intended for export underwent bacteriological investigation because the importers required the cheese to be free from spore-producing bacteria.

Other dairy products

Trials on the utilisation of *cheese whey* showed that with the use of the ultrafiltration process products with an outstanding protein nutritional value and pure lactose and glucose syrups can profitably be made from whey. The whey protein can be incorporated in milk fairly cheaply. Technological techniques were developed by means of which the composition of the protein-enriched whey can be adapted at will, in

accordance with the demand, so that it could, for instance, be used as a cheaper surrogate for skim-milk powder for the control of kwashiorkor.

The ultrafiltration pattern for non-protein nitrogen and the mineral salts was studied. It became apparent that electrodialysis will have to be used in addition for final demineralisation. Fast control screening tests for proteins, lactose and glucose, which can be carried out under factory conditions, were developed.

These developments could contribute to the replacement from local sources of the 4 200 tons of lactose (pure and demineralised) still imported for various purposes.

In co-operation with a commercial undertaking *goat's milk* has been successfully powdered in order to make it more readily available to babies and toddlers who are sensitive to cow's milk. The product has hitherto only been available in liquid and evaporated form, on a limited scale.

Yoghurt is probably the dairy product with the best health image. An exciting development is the introduction of soft or hard frozen yoghurt which can be offered for sale in almost the same way as ice-cream. Several formulas and techniques for preparing this product were investigated and the results will shortly be made available to the local industry.

The presence of *aflatoxins* which are toxic and carcinogenic metabolites of certain strains of *Aspergillus flavus* in any dairy product, is undesirable. Groundnuts seem to be the preferred substrate of this fungus, especially in certain areas. Since groundnut oilcake is commonly used as a protein source of balanced rations there is a potential danger that the aflatoxin, if present in the ration, will be ingested by animals and excreted in the milk.

Milk powder samples from factories in the Transvaal, Natal and Cape Province were collected at monthly intervals over a period of one year. No aflatoxins were detected in any of the samples.

Bacteriological tests and flavour evaluations were used to determine the *shelf life* of pasteurised milk, cream, yoghurt and cottage cheese collected from different factories. Mainly because of post-pasteurisation contamination, the keeping quality of most of these products was found to fall considerably short of the shelf life normally desired of such products.

Miscellaneous

Taxonomic criteria, both constant and discriminative, were selected to form a diagnostic table for laboratory identification of the *propionibacteria*. A collection of 78 was classified by numerical methods. The organisms were characterised according to 260 different coded features.

The data were subjected to computer analysis in which the similarity coefficient and the matching coefficient were calculated and the results clustered by single-linkage analysis techniques. Fixed levels

of agreement were chosen to define genera (65%) and species (75%).

Two major clusters were recognised at a similarity level of 65% corresponding taxonomically to the genus level. Five clearly separable species were defined at the 75% level and a total of 11 bacterial groups were found at the 85 to 90% agreement level. The clusters and subgroups were readily distinguished from one another by several unrelated phenotypic characters.

Several micro-organisms are being tested for the production of β -galactosidase enzymes. Simple growth media are at present being investigated with lactose as the carbon source, and purification methods are being studied in order to cut costs. Methods of immobilising the enzyme are also being investigated with a view to cost reduction.

At present the cheese starter laboratory has over 80 strains of *starter organisms* which are being maintained and kept active. The laboratory is already able to compose cultures as the need arises. Although the literature would suggest otherwise, the incubation of starter cultures at 15 °C did not produce higher activity than incubation at 22 °C. The same maximum was attained at both temperatures, although it took about 24 hours longer at 15 °C.

A combination of guanine (0,1%) and yeast extract (at concentrations < 0,5%) in milk provided better stimulation of the cultures than yeast extract alone at the same concentration. Increasing the concentration of the yeast extract to over 0,5% did not contribute to a further improvement in activity either with or without guanine.

Dairy Science Ancillary Services

Quality improvement laboratory

The Quality Improvement and Technological Extension Laboratory of the Animal and Dairy Science Research Institute carried out a bacteriological and chemical examination of 700 butter samples during the year under review. A comparison was drawn between the laboratory's objective evaluation of quality and the compulsory subjective grading of the product. When judged subjectively, 90% of the samples were found to comply with the standard, but according to the objective laboratory criteria the figure was only 30%. All results and any information and advice arising from them are brought to the attention of the manufacturers and where necessary their factories are visited in order to give assistance - for instance in cases where the results have revealed certain weaknesses in the production methods. Several factories experiencing bacteriological problems were assisted in tracing the sources of contamination and eliminating them.

A large number of samples of butter specially intended for export were examined by the laboratory in accordance with the specifications of the purchasers. This examination showed that some of the local factories could comply with strict requirements relatively easily.

Since it had been requested to do so, the Quality Improvement Laboratory continued to check the bacteriological content of the UHT milk at one of the factories. Certain local authorities have made the distribution of the product in their areas conditional upon the Quality Improvement Laboratory's continuing with bacteriological control. Problems experienced with unstable milk, i.e. milk unable to withstand the heat treatment, were investigated and solved.

Samples of milk powder are also being examined by the Quality Improvement Laboratory. The demand for these services increased as the big distributors started to stipulate quality requirements. Factories experiencing problems are visited and helped to improve their products.

Quality purchasing of milk

With the prospect of the introduction of a milk purchasing scheme that will take bacteriological quality into account, a pilot scheme was started in the Western Cape. Information was made available on the purchasing of equipment and the execution of the methylene blue test.

In co-operation with dairy firms and farmers' associations both inside and outside the Region, 25 meetings were addressed in order to explain the scheme and its implications to producers. At the same time lectures were held on sources of infection and the washing and sterilisation of equipment.

Surveys on the bacteriological quality of the milk received from their producers were held at all the factories in the Western Cape. As might be expected, the prevailing temperature had a decided effect on the quality. There were also considerable differences between factories. In all cases where factories employed extension officers the quality was better.

Experience has shown that it is impossible to take a sample for the ten-day composite sample and for the methylene blue test on the same day. The question whether there is any difference in the reliability of nine-day and ten-day composite samples was investigated. Milk samples from 184 producers were taken daily at two factories and analysed, and the average composition for the ten-day period was calculated from the data. One day per producer was omitted at random and the calculation repeated. The differences, for both the fat and the protein percentages, were too small to be of any practical significance.

Since the infra-red analyser came into operation in October 1975 the number of cows in the Milk Recording Scheme has increased from 4 000 to just over 10 000. This means that the machine is working virtually at full capacity.

After the publication of the work of Prof. Renner of Germany, it was decided to analyse individual samples for *lactose* in order to give producers an indication of which cows are suffering from mastitis. Because no follow-up work could be done, it was decided to use some of the distribution curves to determine the division between normal and abnormal milk. The data was classified according to breeds and stage of lactation and the

dividing points were established with the aid of the distribution curves. The following table was drawn up from the data.

Month of lactation	Limits, lactose percentage	
	Frieslands	Jerseys
1 to 3	4,8	4,7
4 to 6	4,7	4,7
7 to 9	4,6	4,6
10 to 12	4,4	4,5

In some herds all the cows fell below these limits. Investigation showed that this was due to malnutrition. While it is readily conceded that this method is not infallible, it does hold great advantages in mastitis control.

The past summer was characterised by the incidence of rancidity in milk on various farms as well as in dairies. A great deal of time was devoted to tracing the causes and to extension. On farms the cause in most cases was that too much air was being sucked into pipeline systems. In some cases rancidity was related to mastitis in the herd.

Training in dairy science

During the year under review several courses were held for technicians in the dairy industry. The advanced course was very well attended. Thirteen candidates obtained their diplomas in dairying.

The diploma course consists of an introductory and an advanced section, which are presented in alternate years. In the latter course attention is given mainly to the manufacture of dairy products such as milk powder, condensed milk, etc.

With a view to the introduction this year of a scheme for purchasing industrial milk on the basis of its hygienic properties, a course was presented to standardise the method of determining these properties. Fifteen candidates attended a successful course. The attendance figures for some courses, such as those on cream testing and cream grading, were disappointing, however.

A course on milking was presented at the Elsenburg College of Agriculture by the staff of the Animal and Dairy Science Research Institute.

LIVESTOCK AND PASTORAL PRODUCTS IMPROVEMENT SCHEMES

NATIONAL MILK RECORDING AND PROGENY TESTING SCHEME

The Scheme is administered by five milk recording co-operatives with strategically situated laboratories containing sophisticated equipment with which tests can be carried out for butterfat, protein and lactose. Laboratories have been equipped at Elsenburg, Bloemfontein, Port Elizabeth, Thornville and Irene.

As a result owner sampling again increased - about 96 901 tests, to 411 061 tests. Including tests carried out by the conventional method, a total of 589 082 tests were carried out, the most so far.

The testing of young dairy breed bulls is in full swing at present and provision is also being made for smaller breeds.

So far 28 Friesland, six Jersey, three Guernsey and three Ayrshire bulls have been referred to the advisory committee for testing. 313 herds were recruited for this purpose and agreements entered into with the owners. They collaborate under the technical supervision of the Institute. In all 7 510 grade heifer calves have been identified.

THE NATIONAL BEEF CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

Despite the less favourable economic climate the performance testing scheme has attracted increasing interest, especially from the stud industry. The accompanying table shows the number of members of the scheme per regional office and the masses determined over the past year. It is evident from the table that the membership has decreased over the past year to a total of 1 139 breeders. This is ascribed chiefly to the reduction in the number of members in South-West Africa and the Free State.

However, the number of mass determinations increased by 46 926. This includes determinations of the masses of breeding cows at the birth and weaning of the calf.

Number of members and masses recorded, 1976/77

Office	Members		Masses determined	
	1975/76	1976/77	1975/76	1976/77
Transvaal	350	390	68 471	86 183
Natal	176	180	60 039	67 700
South-West Africa	207	171	47 252	54 622
Northern Cape	156	148	25 737	36 638
Eastern Cape	139	138	26 707	27 172
Free State	109	95	12 146	14 908
Western Cape	16	17	1 891	1 946
Total	1 153	1 139	242 243	289 169

The total number of cows that participated in this scheme was 212 000.

Participation in Phase C was affected by a modified testing procedure and by building taking place at Irene and Armoedsvlakte. Table 2 indicates the number of bulls tested per testing centre.

Utilisation of bull stable facilities - 1976/77

Centre	Applications	Capacity	Accepted	%	Tests started	%	Tests completed
Irene	213	167	185	110,7	148	109	110
Armoedsvlakte	191	190	162	85,2	146	76,8	144
Queenstown	179	200	139	69,5	95	47,5	94
Matjijene	9	100	9	9,0	9	9,0	9
Total	592	657	495	75,3	398	60,5	393

The growth tests of bulls on the farms of owners were again very well supported, although 390 fewer bulls were tested than during the previous year. The total number tested was 1 456.

A carcass evaluation programme on a progeny testing basis was investigated during the past year through the analysis of eight progeny groups consisting of eight animals per group.

These results will be analysed in order to lay down a procedure for a programme of this type.

NATIONAL WOOLLED SHEEP PERFORMANCE AND PROGENY TESTING SCHEME

This scheme gained an additional seven members, which brings the numbers up to 92 and another seven applications for membership have been received. Farmers are showing increasing interest in the scheme, especially in the case of young breeders' societies such as the Döhne Merino Breed Society and the breeders' society for performance tested Merinos.

During the year under review 19 874 wool and mohair samples were analysed. This is 2 245 more than the record number analysed the previous year. New equipment was acquired to make the carding process easier and more efficient.

NATIONAL MUTTON SHEEP PERFORMANCE AND PROGENY TESTING SCHEME

During the year under review performance tests were carried out on almost 4 000 more ram lambs than during the previous year.

In flocks which are participating in the Scheme and in which it has lately been the practice to select against prolapse of the rectum, backward bending of the foreleg below the knee and over-development of the lower jaw, far fewer problems were noted during the year under review.

NATIONAL PIG PERFORMANCE AND PROGENY TESTING SCHEME

The pig improvement scheme was recently reviewed and certain changes were proposed which were accepted by the Advisory Committee for Pig Testing.

The main emphasis was placed on all-boar performance testing as the broad basis of central testing in order to identify superior breeding

material. The boars are placed in categories according to their performance results and only the cream of these boars are eligible for progeny testing which includes full carcass evaluation. The top progeny-tested boars will be recognised by the Pig Breeders' Society of South Africa as "elite boars."

Pig Recording and Health Control Phase

The scheme has 52 members, and these are responsible for the vast majority of the total annual registrations. The Cape has 17 herds, Natal 9, OFS 8 and the Transvaal 18. The accompanying table illustrates the number of litters recorded on a provincial and breed basis.

Province	Number of litters recorded	
	SA Landrace	Large White
Cape	571	92
Natal	504	129
OFS	456	154
Transvaal	1 411	425
RSA	2 942	800

Total litters = 3 742

Boar Performance Testing

The accompanying tables show the average performance of boars and gilts tested at Elsenburg, Cedara and Irene and born from 1976.

Progeny Testing

Progeny testing has been centralised at the Irene Testing Centre. A progeny group consists of a boar (castrated) and a gilt selected from a litter at random. The growth and carcass evaluation of five such groups bred by a boar are required before such a boar is considered to be fully progeny-tested.

During the year 27 SA Landrace groups and 21 Large White groups were received at Irene.

RANDOM SAMPLE EGG PRODUCTION AND BROILER TESTS

This tests were again very well supported. Far more applications were received at Irene than could be accommodated. There was less interest in the test at Glen, however, because the hens of very few breeders were able to comply with the requirement that they be PPLO-negative. The first test at Irene in which overseas breeders participated went off successfully. Although some overseas breeders did well, their hens were not significantly better than those of local breeders. One of the biggest problems experienced with overseas hens is the exceptionally large eggs they lay. The South African market is not geared to absorbing such a high percentage of extra large eggs.

There is considerable interest overseas in the South African egg production tests. Eight overseas entries were accepted for the 1976 to 1978 test. However, in future overseas entries may well be restricted to breeders who intend to export poultry to South Africa.

Two very successful broiler tests were held at Irene and Glen. At the moment there are only three broiler breeders in the country. Several breeders buy parent stock from the basic breeders and sell commercial broilers. Many of the breeders are afraid that the basic breeders may stop selling parent stock, in which case their own enterprise would collapse.

POULTRY MULTIPLICATION SCHEME

All breeding material from imported broiler strains is kept at Irene, where it is maintained and selection trials are carried out. Up to the end of June 1977 no less than 8 164 dozen eggs were sold to interested breeders. A further 26 922 dozen eggs were issued to Onderstepoort for vaccination preparation.

The first experimental plastic chicken rearing house in South Africa was put into operation at the

Boar Performance Testing

Breed	n	% Qualified	FCR (range)	Average Performance	
				ADG (kg) (range)	C + K mm (range)
SA Landrace	752	46	2,91 (2,10-4,11)	0,85 (0,64-1,09)	38 (17-54)
Large White	226	69	2,79 (2,30-3,42)	0,90 (0,68-1,09)	37 (28-53)

feeding unit at Irene. The structure was donated to the Department by a private firm. It will only be possible to judge the efficiency of the structure after ticks have been reared in it during various seasons of the year. The trials should be completed by the end of May 1978.

Two local breeders imported egg production feeding material. The sample donated to the State being kept at Potchefstroom and Glen. About 10 dozen hatching eggs have already been sold to interested persons.

ANIMAL HEALTH

VETERINARY RESEARCH INSTITUTE

Judging by the extent of the diagnostic work undertaken and the number of enquiries received during the year, there was a notable decline in the incidence of insect-borne diseases such as bluetongue, horse sickness, Rift Valley fever and Wesselsbron disease, probably as a result of the more normal climatic conditions, particularly rainfall. There were consequently greater opportunities for pursuing research on these and other diseases.

Research undertaken during the past year revealed two new bluetongue virus types, in addition to the 16 already known. During the late summer and autumn of 1976, when there was a serious outbreak of bluetongue, types 18 and 19 were isolated from blood specimens of sheep. Type 19 was particularly widespread in the southern and western parts of the Orange Free State. These new virus types are now being attenuated for eventual incorporation in the bluetongue vaccine.

Studies on the life-cycle of redwater parasites in their tick hosts have thrown considerable light on the epidemiology and other hitherto unknown aspects of the disease, and continued research has shown that cattle may be successfully immunised against *Babesia bovis*, one of the two redwater parasites, by simultaneous inoculation and treatment.

It would appear from a follow-up investigation into the causes of abortions in cattle that, in addition to brucellosis, leptospirosis also plays an important part. On the other hand research has proved that Wesselsbron disease, hitherto regarded as an important cause of abortions, can be incriminated in only exceptional cases. A survey has further shown that Q fever, also a possible cause of abortions, is widespread in the sheep and cattle herds in this country.

Chlamydiosis, the cause of enzootic abortion in sheep, is apparently still one of the most important causes of neonatal losses in cattle and sheep. One of the most interesting findings during the year was the serological confirmation that Akabane virus, a cause of prenatal malformations, is fairly common in sheep and cattle in South Africa.

Promising results have been obtained from research on heartwater. Infected bont tick nymphae, it has been discovered, contain such a high concentration of the heartwater organism that the possibility of producing a vaccine from infected nymphae instead of from sheep blood is currently receiving attention. Good progress has also been made with research on *Parafilaria* infestation (false bruising) in cattle and, *inter alia*, it has been found that treatment with the compound nitroxinyl provides a five-month protection against infection in cattle.

Laboratory investigations have indicated that poisoning of stock with pesticides containing chlorinated hydrocarbons and organophosphates is on the increase and that gousiekte and seneciosis were the most important causes of plant poisoning during the year. Cases of photosensitisation in sheep have been produced with the fungus *Pithomyces chartarum*, which has been isolated from dubbeltjies, and the connection between fungus-infected dubbeltjies and geeldikkop is receiving further attention.

Two new vaccines were released this year for general use, namely one against *Clostridium septicum* infection and a supplementary vaccine against bluetongue. This brings the total number of vaccines produced at the Institute to 45.

The demand for vaccines decreased considerably during the year, only 159,2 million doses having been issued as against 170,9 million in the previous year. The decreased incidence of Rift Valley fever, Wesselsbron disease and bluetongue largely accounts for the reduced demand for vaccines. On the other hand, there was an increased demand for certain bacterial vaccines and an outbreak of lumpy skin disease created an unexpected demand for this vaccine.

By 1 June 1976 the Institute had 160 registered research projects. A further 44 projects were undertaken and 18 were finalised. A total of 40 scientific articles were published during the year.

VETERINARY RESEARCH BACTERIAL DISEASES

Footrot and foot abscess in sheep

The discovery that footrot does not occur in South Africa while foot abscess does, has resulted in greater attention being paid to the latter disease. Attempts to immunise animals through the skin against infection with the organisms which cause foot abscess, namely *Fusibacterium necrophorum* and *Corynebacterium pyogenes*, were not sufficiently successful to justify proceeding with the manufacture of a vaccine.

Fowl typhoid

Certain variables which influence the effective and practical immunisation of poultry against fowl typhoid have received attention. What has been established is that neither the existing live vaccine nor the inactivated alum-precipitated or oil-emulsion vaccines conferred satisfactory immunity within 7 days, whereas satisfactory



protection was provided with the former and the latter after 14 days. None of the vaccines adversely affected the immunising properties of a follow-up injection of a live vaccine. However, therapeutic doses of furazolidone had a detrimental effect on immunisation with live vaccine, and administration of live vaccine during the incubation period of the disease had no effect. An outbreak of fowl typhoid can therefore best be controlled by an initial administration of furazolidone together with an oil vaccine, followed by live vaccine, once therapy has been discontinued.

Mycoplasmosis

Preliminary investigations on pigs indicated that *Mycoplasma hyosynoviae* was more often associated with lung pathology than *M. hyopneumoniae*, which is regarded abroad as the most important cause.

Maduromycosis

Maduromycosis, a fungus disease attacking the skin and organs of animals, with fatal results if surgery is not performed, was diagnosed in horses for the first time in South Africa.

Diagnostic work

The marked decrease in the number of specimens submitted for examination for suspected colibacillosis may possibly be attributable to the efficacy and more general use of the vaccines for cattle and pigs. *Salmonella dublin* is still the most important cause of paratyphoid of calves, whereas *S. typhimurium* was isolated from poultry more often than *S. gallinarum*. The majority of *Corynebacterium* abscesses in cattle were caused by *C. pyogenes*, while the latter and *C. ovis* were equally responsible for such cases in sheep.

PROTOZOAL DISEASES

Redwater

Recently completed studies on the life-cycle in their tick hosts of the two causative parasites of redwater in South Africa, namely *Babesia bigemina* and *Babesia bovis*, have thrown much light on epidemiological and other aspects of the disease. The fact that *B. bovis* is transmitted by the larval stage of the blue tick, that is shortly after the tick has attached itself, provides an explanation for the field observation that the disease cannot be controlled by weekly dipping alone. It was also established that infected red blood cells adhere to each other and to the walls of smaller blood vessels of the brain. This offers an explanation for the occurrence of severe nervous symptoms in advanced cases in animals infected with *B. bovis*. The fact that the infection is easily transmitted to the next generation in blue ticks that have been infected with *B. bigemina*, whereas this does not occur with *B. bovis*, probably explains why *B. bigemina* is generally more widespread than *B. bovis*.

Continued field trials have established that adult animals such as pregnant cows, for example, can be successfully vaccinated against infection with *B. bovis* if simultaneously injected and treated with the drug diminazene. Where animals have to be inoculated against *B. bovis*, it is now recommended that they be protected by single administration of the drug from five days before to five days after inoculation. However, diminazine sterilises *B. bigemina* infections and may not be used where immunity against this parasite is required.

It has been established that thick blood smears may be used successfully, especially with calves, to determine the incidence of *B. bigemina* in a farm. Such epidemiological examinations have revealed that 75% and more of calves under the age of 6 months on farms in the Eastern Transvaal, Highveld, the Springbok Flats and Arid Sweet Bushveld are affected by this parasite. From this it can be inferred that every calf born in these areas is subclinically infected with redwater early in this life and in that way becomes immune.

Dourine

During the year 1982 serum specimens were tested for dourine; 66 (3.6%) were positive, a slightly higher percentage than that for the previous two years. The distribution of these cases was as follows: Transvaal 4, the Cape 9, OFS 3, Natal 1, Botswana 5, Lesotho 12, Rhodesia 1, South-West Africa 31. It is clear from these statistics that fewer than a quarter of these cases occurred in South Africa.

Diagnostic work

Blood smear examinations have shown that 56% of the alleged outbreaks of protozoal diseases were not due to that cause, and that anaplasmosis

accounted for 25%, *B. bovis* for 7%, *B. bigemina* for 5% and unidentified *Babesia* spp. for 3% of alleged outbreaks of protozoal diseases.

VIRUS DISEASES

Rabies

A greater measure of success was achieved this year with growing rabies virus in tissue culture. High virus titres, comparable to those provided by embryonated eggs, were obtained with the high egg passage (Flury) strain. An experimental vaccine has been prepared and is currently being tested in dogs and cattle.

During the year 1040 specimens were examined for rabies; 222 (21%) were positive. Forty-four of the positive specimens were from South-West Africa and the balance from the Republic. The incidence of the disease among the various hosts was as follows:

Cattle	58
Yellow mongooses	50
Other mongooses	21
Dogs	48
Jackals (including bat-eared foxes)	13
Domestic cats	10
Species of wild cats	3
Other wild carnivores	6
Wild ruminants	3
Other farm animals	6
Humans	4

A specimen of canine brain material received from Botswana reacted like rabies in the biological test and also showed intracytoplasmic inclusion bodies. The fluorescent test, however, was negative for rabies and the virus was identified as that of Wesselsbron disease.

Bluetongue

During the late summer and autumn of 1976, when bluetongue was widespread, bluetongue virus was isolated, by intravenous administration in embryonated eggs, from 66 of the 215 specimens submitted for examination. The strains were typed by means of recently produced, highly specific bluetongue anti-sera in a much improved plaque-inhibition test, and two new serotypes, 18 and 19, were identified. Type 19 is fairly widespread in the southern and western parts of the Free State. The situation regarding the other serotypes remains virtually the same as it was in 1959. The new virus types are now being attenuated for inclusion in the vaccine.

Swine fever

Studies on various strains of swine fever virus showed that their virulence varied from high to low. Two of these strains only caused subclinical infections. In contrast to the more virulent strains, it was also not possible to isolate the virus from the tissues of infected pigs in cell culture, apparently because of the very low concentrations of the virus in the tissues. Whereas non-haemadsorbing virus

populations of one strain consistently caused subclinical infections, and haemadsorbing virus populations of the same strain resulted in a per-acute or acute form, haemadsorbing virus populations of two other strains caused subclinical or mild forms of the disease. From this it would seem that the haemadsorbing property cannot be linked to virulence or pathogenicity.

Virus diarrhoea of pigs

Diarrhoea of pigs is one of the greatest problems confronting the pig farmer. The possibility that viruses are involved is being investigated. Rota virus has recently been demonstrated in the faeces of pigs by means of the electron microscope, and this has led to an investigation of the pathogenicity of this virus.

Virus diarrhoea of calves

The faeces of live calves with early untreated diarrhoea was examined for the presence of viruses and other pathogenic organisms. Rota (reo-like) and corona virus particles were observed in various specimens with the aid of the electron microscope. In some cases it was possible to isolate as many as three different pathogenic organisms from the same calf, an indication of the complexity of the problem.

Seven newborn calves that had received no colostrum were dosed either with faeces in which

electron microscopy had demonstrated rota virus, or with tissue cultures in which the virus had been grown. All the calves developed diarrhoea and rota virus could be demonstrated in the faeces of six of the calves. It can therefore be concluded that rota virus is responsible for diarrhoea in calves.

Akabane virus

One of the interesting findings of the past year was the serological confirmation that Akabane virus, which may be responsible for prenatal malformations, is fairly common in sheep and cattle in South Africa.

Wesselsbron disease

Clinical, haematological, chemopathological and pathological studies on Wesselsbron disease in new-born lambs and kids indicated that the disease is basically the same in both species except that more lambs (29%) than kids (19%) die of it. It was also established that Wesselsbron disease could be distinguished from Rift Valley fever on the basis of histopathological changes in the liver.

Only one out of 17 pregnant cows that had been infected with Wesselsbron disease aborted. Apart from a two-day febrile reaction, no symptoms of disease were observed in these cows. It would seem, therefore, that Wesselsbron disease is not an important cause of abortion in cattle.



The oxpecker can make a tremendous contribution to the control of ticks and other exoparasites in cattle

Jaagsiekte

Continued research indicated that jaagsiekte can possibly be established in sheep in two ways:

By the transmission of living cancer cells from an affected to a susceptible sheep. This occurs in male animals that are infected with a cell culture containing male cells. Within a year these sheep develop extensive lung lesions with a male karyotype. Transplantation of tumour cells therefore apparently takes place.

When ewes are infected with the same material they develop tiny lesions which are first perceptible a year later. In this case the tumour cells are female, which suggests that transformation of the host cell takes place. It is still not clear, however, how the transformation process is induced.

INFERTILITY AND VENEREAL DISEASES

Chlamydiosis

Further observations were carried out on lambs, born from ewes infected with chlamydiosis, that did not succumb at birth. At 12 months these lambs were not much heavier than normal lambs at 6 months. At autopsy they exhibited general maciation, interstitial nephritis and hyperplasia of the lymph tissue, i.e. lesions normally associated with chlamydiosis.

Diagnostic examinations for chlamydiosis showed that *Chlamydia psittaci* was responsible for neonatal losses in 17% of 118 sheep flocks and 11% of 535 cattle herds examined. The incidence in cattle was considerably lower than in the previous year, and sheep also showed a decreased incidence. This tendency is probably due to the use of the Onderstepoort vaccine.

Brucellosis

Brucella isolates, obtained from buffalo in the Kruger National Park by the Division of Veterinary Services, were classified as *Brucella abortus* biotype I. This is the biotype which is usually encountered in cattle, whereas biotype II is the original strain from which other biotypes have developed. This would seem to indicate that buffalo are not the original source of infection for cattle; rather the reverse would be nearer the truth. The same observations were made on *Brucella* isolates from waterbuck and eland originating from Rhodesia.

Special attention has once again been given to the isolation and identification of *Brucella* strains from the foetuses of cattle and other material derived from farms where abortions occurred. *Brucella abortus* was confirmed on 13% of the 535 farms studied. The corresponding figures for 1975/76 and 1974/75 were 15% and 7%, respectively.

One *Brucella* strain derived from sheep and 90 strains from cattle were typed by means of biochemical and serological tests. With the exception of one strain from cattle, which was

identified as *B. melitensis*, recorded for the first time in South Africa, all the others proved to be *B. abortus* biotype I.

Eleven per cent of the 35 641 serum specimens from cattle examined for brucellosis proved to be positive - the same incidence as in 1975/76.

The incidence of *Brucella canis* in dogs was confirmed serologically for the first time. Only imported animals were involved.

Q fever

The results of serological surveys showed that 26% of the 225 sheep sera and 4% of the 2 154 cattle sera tested for *Coxiella burnetii* infection were positive. The positive cases, representing 44% of the sheep flocks and 28% of the cattle herds examined, confirm the suspicion that the incidence of this infection must be fairly widespread.

Leptospirosis

Serological evidence that leptospirosis is an important cause of abortion in cattle was again obtained. Of the 168 herds examined, 14% were positive for *Leptospira pomona*. Sheep were consistently serologically negative.

Vibriosis

Campylobacter fetus intestinalis was isolated from 13 cattle foetuses, showing once again that vibriosis should not be overlooked as a possible cause of late abortions.

The continued survey on vibriosis in bulls and cows has shown a 3% incidence as against 5% in the period 1975/76. This decline in the occurrence of the disease must be attributed to increasing use of the vaccine.

Trichomoniasis

Examination of 2 811 bulls for trichomoniasis showed that 6,2% of the animals were infected, as against the 4,7% found to be infected in the 1975/76 survey. Thirty-nine bulls were infected with both *C. fetus* and *Trichomonas foetus*.

Studies on the cause of "epivag" in cattle

Continued studies have indicated that, although *Mycoplasma* strains and *C. psittaci* may often be isolated from female animals from herds in which the "epivag" syndrome occurs, this is not always possible in bulls. Lesions which were observed fairly regularly in affected bulls were an epididymitis with pronounced testicular atrophy and a vesiculitis. The latter often occurred before lesions could be detected in the external genitalia.

Viruses and infertility

Fifteen virus strains isolated from the genital tracts of bulls and cows with sterility problems were characterised and it was established that they all belonged to the herpes virus group. Twelve of these were slow-growing in tissue culture and unrelated to IPV-IBR virus, whereas the other

three strains were antigenically identical to IPV-IBR. An attempt is being made to determine whether these viruses are involved in the "Epivag" syndrome.

Extension work

During the year under review considerable attention was devoted to extension work on the diagnostic methodology in connection with sterility and perinatal losses. Officers of the regional laboratories and diagnostic centres of the Division of Veterinary Services and veterinarians and technicians from the homelands and neighbouring states visited the Institute for training purposes. In addition lectures were given to State veterinarians, farmers and agricultural students on five occasions.

MASTITIS

Mastitis research

Recent studies have demonstrated the presence in mastitic milk of three different fibrin-like substances derived from fibrinogen as well as thrombin, in addition to the serum-albumin referred to in a previous report. These fibrin-like substances also occur in normal colostrum, whereas normal milk contains only low levels of one of the fibrin-like substances. The presence of these substances is related to the release of thrombin from damaged cells and is connected with the healing activity of the mammary organ.

Diagnostic and extension work

During this year 3 018 specimens of milk from herds with serious mastitis problems were examined. Of these, 272 showed evidence of latent infection with mastitis-producing organisms, 834 indications of aseptic mastitis and 611 typical signs of mastitis. In addition to specific instruction to the owners and other farmers on the correct way to deal with their mastitis problems, general information on the prevention and control of mastitis was made available by means of popular publications and pamphlets.

DISEASES OF FISH

Particular attention was given to the diagnosis of diseases of fish this year. Diseases of trout could be attributed chiefly to malnutrition. Vitamin C deficiency, characterised by skoliosis and cyphosis, was observed, while whirling disease, caused by a protozoal parasite, was also diagnosed. Poor oxygenation of the water was responsible for mortality among kurpers and carp.

POISONING

Photosensitivity

Highly toxic, sporidesmin-producing strains of the fungus *Pithomyces chartarum* were isolated from dubbeltjies near Aberdeen and it was possible to produce cases of photosensitivity in sheep by means of cultures. An attempt will now be made to

produce typical cases of geeldikkop with these fungi.

The same condition was diagnosed in cattle grazing a rye grass/clover pasture. Various toxic strains of *P. chartarum* were isolated from the rye grass and photosensitivity was produced experimentally.

Poisoning with rafoxanide

It has been established that one of the effects of overdosing with this commonly used anthelmintic is blindness in sheep. Overdosing usually occurred on account of an overestimation of the weight of the animals, with the result that the recommended therapeutic dose was exceeded. Rafoxanide is neutrotoxic, and lesions occur in the central nervous system and in the retina of the eye.

Chronic zinc poisoning of sheep

In view of field reports that suggested that sheep had died as a result of chronic zinc poisoning, the effect of zinc in the form of zinc sulphate administered over an extended period was investigated. However, no signs of chronic zinc poisoning could be found in sheep that had received up to 30 mg of zinc per kg/mass daily over a period of 11 months. A drop of 50% in the copper content of the livers of these sheep occurred, but the condition became stabilised after four months and did not reach a critical stage. The liver function of these sheep was not impaired, and the fact that the zinc content of the faeces was 30 times higher than in the control sheep suggests that the animals eliminated the excess zinc by this route.

Diagnostic work

Pesticides containing chlorinated hydrocarbons and organophosphates once again accounted for the majority of cases of poisoning in ruminants. Poisoning with chlorinated hydrocarbons increased despite the ban on substances such as dieldrin, which remains the single most important poison in the above groups of compounds.

Urea poisoning has decreased, apparently because of better guidance on the use of urea, but like arsenical poisoning it is still the cause of unnecessary mortality among stock.

Nitrate poisoning, an unusual type of poisoning, increased during the past year. This is due to an increase in the nitrate content of borehole water in certain areas on account of the abundant rains of the past few years. Salt poisoning is still an important cause of deaths among cattle, pigs and poultry, especially when the water supply is inadequate.

Castor-oil seed was the cause of poisoning in cattle, horses and pigs in two instances where unidentified goods were purchased at an auction. Mycotoxicosis caused by the feeding of mouldy "maroek" is still fairly common.

Judging by the field specimens submitted for histopathological examination, seneciosis and

gousiekte were the most important types of plant poisoning in ruminants.

INTERNAL PARASITES

Resistance of wireworm to drugs

A few years ago a wireworm strain resistant to thiabendazole was discovered at Onderstepoort. Good results to treatment, however, were still obtained with other related benzimidazoles, especially fenbendazole. This year, however, sheep and goats which had been treated with mebendazole shortly before succumbed to wireworm infestations and it was established that the strain responsible was resistant even to fenbendazole. Cross-resistance was therefore present in this particular strain. Resistance of wireworms to thiabendazole has also been observed elsewhere in South Africa.

Parafilariaasis of cattle

Continued research at the Zoutpan Research Station has shown that weekly dipping with chlorfenvinphos does not reduce the numbers of vector flies to any great extent. The only alternative is to try to control the worm in the host.

Studies on the life cycle of the parasite in the fly *Musca xanthomelas* have established that at 28 °C the young worm takes eight days to reach the adult infective stages and that some worms die in the process.

Further therapeutic studies with nitroxylnil at Zoutpan have shown that this drug provides the animals with protection from bleeding points for 5 months, i.e. keeps them *Parafilaria*-free. This method not only gives promise of successful treatment but also of the control of the disease in an affected area. What must still be determined, however, is the length of time residues of the drug remain in the tissues. Artificial infestation has shown that lesions in the carcass become detectable 4½ months after infestation.

EXTERNAL PARASITES

Resistance of ticks to dips

The survey on the occurrence of resistance of ticks to dips was continued. The tests used are now applied to both larval and adult ticks. The data obtained from larval tests were analysed statistically by means of a graphic method showing population trends. The new method clearly demonstrates the presence of populations of blue ticks *Boophilus* spp. that are resistant even to chlorfenvinphos, and the apparent resistance of brown ear ticks *Rhipicephalus appendiculatus* to dioxathion. Dioxathion represents the Group I and chlorfenvinphos the more recently developed Group II organic phosphate dips. Experience has shown that cross-resistance occurs among the Group I compounds. It is already evident that sooner or later a resistance problem will develop in the case of blue ticks.

Biological control of ticks

Further research on ox-peckers has established that a single bird can ingest approximately half its weight in ticks in a day, and in one day can consume 6 850 engorged bont tick larvae *Amblyomma herbraeum*. It is clear from the research carried out over the last few years that, if ox-peckers are present in sufficient numbers, they could be instrumental in substantially reducing the tick population. Investigations are being conducted on the susceptibility of ox-peckers to dips and their wound-picking habits.

Black flies *Simulium* spp.

Owing to the low rainfall along the Vaal River black flies increased to plague numbers at the beginning of 1977. With the co-operation of the Department of Water Affairs, it was decided to test water manipulation instead of spraying with chemical compounds as a control measure. This new method was aimed at the elimination of the immobile pupal and egg stages of these flies. The best results were obtained when the Vaal River was closed off at the weir at Warrenton for 2½ days a week. Less satisfactory results were obtained when this was done only every fortnight.

Blowflies

Field and laboratory trials were carried out to determine to what extent sheep could be protected against onslaughts of blowflies by means of breech treatment with insecticides. In the laboratory, data on compounds against resistant and susceptible strains were analysed statistically with the aid of a computer, with the result that more accurate information is now available. The most promising compounds were compared to the well-known Mules's operation in the field at Riversdale. Sheep which underwent the operation at weaning were found to be fairly well protected. Fenthion-ethyl gave even better results than the operation over a period of six weeks, and diazinon gave comparable results. Mules's operation naturally gives long-term protection. Complete protection of a flock of sheep against breech attacks lasts a maximum of two weeks in the Riversdale district.

Heartwater

A study recently initiated on the multiplication of the causative organism of heartwater, namely *Cowdria ruminantium*, in the vector, the bont tick, has established that only 20% of sheep can be infected by intravenous administration of the saliva of adult ticks, whereas one triturated infected nymphal tick is capable of infecting 100 sheep. Suspensions of infected nymphs containing DMSO can be stored frozen in liquid nitrogen for at least three months and still produce heartwater.

An extensive trial has shown that the dosage of heartwater vaccine for cattle may be reduced from 10 ml to 5 ml. Furthermore, it has been established that the drug dithiosemicarbazone is at

least as effective as tetracycline for the treatment of heartwater.

VACCINE PRODUCTION

During the course of the year the addition of one new vaccine, *Clostridium septicum*, brought the total of vaccines now produced by the Institute to 45.

The total number of doses issued dropped from 170,9 million in 1975/76 to 159,2 million in 1976/77, owing primarily to a decrease in the demand for certain virus vaccines. Consequently the income from vaccine sales also decreased from R1,8 million to R1,7 million.

A cost analysis of vaccine and antigen production resulted in a marginal increase in the price of some products but it was actually possible to reduce the price of some others as a result of improved production techniques.

In the past virtually all vaccines supplied to foreign countries were purchased direct from the Institute through official channels and accurate figures were available. However, the recent trend is for private firms which undertake the local distribution of vaccines to purchase vast quantities of vaccine, much of which is intended for export to Lesotho, Botswana and Swaziland. As the Institute has no control over or information on the extent of this practice, accurate figures are no longer available.

Bacterial vaccines

The total number of doses of bacterial vaccines issued was 5 million higher than last year. A steady increase in the demand for most vaccines and especially those against *Pasteurella*, anthrax, *E. coli*, *Vibrio* and *Clostridium oedematiens* would account for this increase. The demand for lamb dysentery vaccine continued its downward trend, but that for the enterotoxaemia vaccine remained essentially unchanged, though there was marked preference for the alum-precipitated toxoid.

Virus vaccines

The total number of virus vaccine doses issued this year decreased from 88,4 million to 71,7 million. This was primarily due to the fact that there were no major epizootics of insect-borne diseases such as bluetongue, Rift Valley fever and Wesselsbron disease.

There was also a further decrease in the demand for Newcastle disease vaccine but an appreciable increase in the demand for the other poultry virus vaccines, namely fowl pox, infectious bronchitis and infectious laryngotracheitis.

Owing to a severe outbreak of the disease, the issues of lumpy skin disease vaccine increased by nearly 150%, from 1,07 million doses in 1975/76 to 2,51 million in 1976/77, a situation which created intermittent shortages of the vaccine.

Research in the Virology Section established

that certain new as well as some rarer virus strains were responsible for outbreaks of bluetongue. In order to meet this situation a supplementary bluetongue vaccine was produced but only 90 500 doses of it were sold.

Protozoal and rickettsial vaccines

There was a slight drop in the issues of protozoal vaccines because of a decreased demand for anaplasmosis (gallsickness) and redwater blood. This decrease is rather surprising since, according to reports in the field, these diseases are as common as ever.

Diagnostic reagents

These reagents are produced by the Bacteriology and Poultry Sections. There was an increase of approximately 20% in the issues of tuberculin and the total income for all the reagents amounted to R42 668,50, of which tuberculin alone accounted for R37 201,40.

The *Brucella abortus* Rose Bengal antigen introduced during the year will be used widely in the brucellosis eradication scheme and it is anticipated that the demand for it will rise steeply.

Vaccines and antigens supplied to foreign countries

African states	Number of doses	Value (R)
Botswana	386 529	5 606,00
Lesotho	176 900	3 455,00
Mozambique	1 500	60,00
Rhodesia	1 627 691	32 401,74
South-West Africa	881 092	25 983,70
Swaziland	79 038	13 257,60
Zambia	5 162 840	15 626,30
Other		
Israel	63 000	825,00
Totals	8 378 590	R97 215,44
<i>Antigens and dip tests</i>		
Botswana	20 ml	3,00
Lesotho	15 ml	15,00
Malawi	1 915 ml	250,00
South-West Africa	10 ml	1,50
Swaziland	10 ml	1,50
7 175 bottles of dip test fluid		68,00
1 560 tablets		156,00
		R495,10

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Ten scientists from the following African countries visited the Institute during the year: South-West Africa, Malawi, Rhodesia, Botswana, Kenya and Mozambique.

Onderstepoort vaccines were bought by the following neighbouring states (not included are

Vaccine sales

Vaccine	Doses issued		
	1974/75	1975/76	1976/77
<i>Bacterial vaccines</i>			
Enterotoxaemia (oil) (<i>Cl. perfringens</i> D)	33 840 520	17 043 850	9 786 200
Enterotoxaemia (alum) (<i>Cl. perfringens</i> D)	669 700	23 380 000	30 430 610
Enterotoxaemia (total)	34 510 220	40 423 850	40 216 810
Lamb dysentery (<i>Cl. perfringens</i> B)	2 414 100	310 650	270 400
<i>Brucella</i> S19 (cattle)	2 366 269	2 720 796	2 327 598
<i>Brucella</i> Rev 1 (sheep)	581 860	490 250	721 560
<i>Corynebacterium ovis</i>	117 000	144 300	132 340
<i>Corynebacterium pyogenes</i>	374 460	363 100	424 760
Swelled head in rams (<i>Cl. novoei</i>)	63 320	66 850	186 700
Colibacillosis (cattle and sheep) (<i>E. coli</i>)	61 910	72 750	80 710
Colibacillosis (pigs) (<i>E. coli</i>)	86 600	182 400	258 720
Fowl typhoid (<i>S. gallinarum</i>)	2 224 848	4 198 500	3 524 000
Botulism (<i>Cl. botulinum</i> C & D)	4 984 580	5 016 505	5 464 230
<i>Clostridium septicum</i>	-	-	185 580
Bovine pleuropneumonia (<i>M. mycoides</i>)	716 640	242 160	862 800
Anthrax (<i>B. anthracis</i>)	16 520 100	13 402 307	17 077 460
Paratyphoid (live) (<i>S. dublin</i>)	369 022	334 302	329 186
Paratyphoid (inactivated) Trivalent	-	28 020	27 394
<i>Pasteurella</i> (sheep and cattle)	1 371 080	1 518 660	1 933 840
Black-quarter (quarter-evil) (<i>Cl. chauvoei</i>)	7 333 068	10 243 118	10 291 482
Tetanus (<i>Cl. tetani</i>)	131 490	128 330	182 260
<i>Vibrio fetus</i>	13 100	141 900	242 700
<i>Haemophilus coryza</i> (<i>H. gallinarum</i>)	10 000	1 230 800	1 726 500
Total for bacterial vaccines	74 249 671*	81 259 548	86 467 030
<i>Virus vaccines</i>			
Enzootic abortion (<i>Chlamydia</i>)	5 002 100	2 956 200	4 317 700
Bluetongue	18 866 100	26 167 620	20 792 152***
Pigeon pox	569 600	525 180	623 600
Fowl pox	3 095 700	2 816 100	3 359 900
Distemper	30 827	36 673	34 683
Rabies LEP (dogs)	209 866	323 211	291 704
Rabies HEP (cattle and cats)	32 704	64 004	55 369
Infectious bronchitis (poultry)	2 251 000	2 652 000	2 440 000
Infectious laryngotracheitis	9 111 000	4 999 000	7 068 000
Lumpy skin disease	420 991	1 072 899	2 512 023
Newcastle disease (Komarov)	36 557 400	25 559 260	21 448 500
Horsesickness	191 265	182 299	185 834
IBR (Infectious bovine rhinotracheitis)	-	62 450	132 230
Rift Valley fever (live) (sheep)	12 183 700	9 210 450	4 173 260
Rift Valley fever (inactivated) (cattle)	1 007 200	3 776 765	810 250
Wesselsbron disease	5 954 550	7 816 450	3 287 500
Ephemeral fever (three-day-stiffsickness)	50 890	224 465	193 490
Total for virus vaccines	95 534 893**	88 445 026	71 735 195
<i>Protozoal and rickettsial vaccines</i>			
Anaplasmosis (gallsickness) (<i>A. centrale</i>)	595 844	890 413	708 556
Heartwater blood	94 648	101 019	107 350
Redwater (<i>B. bovis</i> & <i>B. bigemina</i>)	95 914	117 583	108 890
Elephant skin disease (besnoitiosis)	89 840	107 710	109 410
Total for protozoal and rickettsial vaccines	876 246	1 216 725	1 034 206
Grand total for all vaccines	170 661 810**	170 921 299	159 236 431
<i>Diagnostic aids (antigens) (in millimetres)</i>			
BWD antigen	31 980	48 390	31 640
<i>Brucella abortus</i> antigen (SAT)	32 820	27 090	28 600
<i>Brucella</i> milk ring test antigen	558	1 353	1 338
<i>Brucella</i> Rose Bengal antigen	-	-	1 900
Mallein	-	-	9
Tuberculin (bovine)	759 420	840 770	97 698
Tuberculin (avian)	290 620	249 740	26 306
<i>Mycoplasma gallisepticum</i> (CRD) antigen	134 700	103 800	4 602
Total for diagnostic antigens	1 250 098	1 271 143	194 011****

*Excluding *Chlamydia*
 **Including *Chlamydia* and excluding horsesickness type 4
 ***Include supplementary bluetongue vaccine
 ****Expressed as ml from 1976/77

vaccines sold to these states by private firms):

	No. of doses
Botswana	386 529
Lesotho	176 900
Mozambique	1 500
Rhodesia	1 627 691
South-West Africa	881 092
Swaziland	79 038
Zambia	5 162 840
	8 315 590

The Institute also received 2 064 specimens from African states for laboratory diagnosis.

Liaison with overseas countries

Visitors

Thirty scientists from abroad paid brief visits to the Institute during the year. In addition, 146 foreign tourists visited the Institute in organised groups.

Vaccines

The Institute sold 63 000 doses of vaccine to Israel.

Total vaccine sales to foreign countries

Approximately 5% of Onderstepoort vaccines were bought from Onderstepoort direct by other countries, mainly neighbouring states. This percentage, however, must be regarded as an underestimation as approved wholesalers also sell large quantities of Onderstepoort vaccines to neighbouring states.

Overseas study tours

Five officers undertook short overseas study tours during the year. Three of these were official visits and the other two were partly financed by the State.

DIVISION OF VETERINARY SERVICES

Towards the end of the year under review there were three outbreaks of *foot and mouth disease* in the proclaimed control areas bordering on the Kruger National Park. These occurred in the magisterial districts of Barberton, White River and Letaba and were caused by the SAT II strain of the virus. Necessary control measures were immediately applied which included the re-vaccination of susceptible animals in the threatened areas and on infected farms as well as intensified control over the movements of cloven hoofed animals and their products.

The number of *rabies* cases in Natal increased in the year under review. A similar tendency was observed in kwaZulu especially in the northern parts. There were, however, fewer cases reported among cattle in the Northern Transvaal.

Three outbreaks of *corridor disease* occurred

in Venda, Gazankulu and Pilgrim's Rest district on farms bordering on the Kruger National Park. A total of 116 cattle died during the outbreak in Gazankulu but the application of the necessary control measures rapidly and effectively brought all three outbreaks under control.

Accelerated progress was made with the *bovine tuberculosis* eradication scheme during the year. The members of the stock inspectorate personnel trained to do tuberculin tests, contributed largely to this success. Altogether 897 391 tuberculin tests were done and 2 754 tuberculosis free certificates were issued during the year under review (723 909 and 2 510 for 1975/76).

A voluntary accreditation scheme for cattle herds free of *brucellosis* was launched during the year. A total of 51 herds have already joined. A diagnostic scheme will also be initiated during the coming year. All animals found to be infected with *brucellosis* will be branded with a C-mark on the right side of the neck. Farmers are advised not to buy or sell animals marked in this manner for breeding purposes.

Sheep scab has once again caused serious problems. Although the number of outbreaks (309) was 53 less than last year, only one less district was involved. During control campaigns 649 873 small stock on infected and contact farms were dipped at least twice under official supervision in an approved dip.

Two outbreaks of *African swine fever* occurred in the proclaimed areas but they were effectively and rapidly controlled without any further spreading. During the outbreaks 45 pigs were slaughtered and the carcasses destroyed.

The scope of the *diagnostic services* rendered by the laboratories of the Division, is expanding and play an increasingly important role in local extension services because the findings of the laboratories are directly applicable to local conditions.

VETERINARY RESEARCH

Miscellaneous research and projects

Officials of the Division of Veterinary Services registered four new projects, continued with work on two and the work on six projects was either completed or discontinued for various reasons during the year under review.

A survey to determine the *resistance of ticks* to dips mentioned in previous reports was continued in Gazankulu. Results so far indicate a resistance to arsenic and toxaphene but not to organophosphates.

In Venda it was found that 21 per cent of bulls and 72 per cent of the dipping units were infected with *trichomoniasis*. The calving percentages in both Venda and Gazankulu were determined and found to be 43 per cent and 46 per cent, respectively.

A survey, begun two years ago, to determine the incidence of the *respiratory disease complex* in pigs in the Western Cape Region was completed. Out of 28 947 pigs originating from 118 farms 9.5 per cent were found upon slaughtering to have lung lesions. The infected pigs came from 77 farms.

**BANTOE-TUISLANDE
BANTU HOMELANDS**

- GAZANKULU
- LEBOWA
- VENDA
- NDEBELE
- KWAZULU
- BOPHUTHATSWANA
- QWAQWA
- TRANSKEI
- CISKEI
- GEBIED VOORLOPIG INGELYF
BY SWAZILAND

AUGUSTUS 1975

**REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA**

**VEEARTSENYKANTORE
VETERINARY OFFICES**

- Direkteur Veeartsenydiens
Director Veterinary Services
- ★ Asst.-direkteur
Asst. Director
- ☆ Staatsveearts
State Veterinarian
- Veterinêre Streeklaboratorium
Regional Veterinary Laboratory
- Staatsveeartswykgrense
State Veterinary Areas Boundaries
- Streekgrense
Regional Boundaries

- 1 Winterreënstreek — Winter Rainfall Region
- 2 Oos-Kaap en Karoo — Eastern Cape and Karoo
- 3 Vrystaat — Free State
- 4 Natal — Natal
- 5 Oos-Transvaal — Eastern Transvaal
- 6 Transvaal — Transvaal
- 7 Hoëveld — Highveld

**REPUBLIEK VAN SUID-AFRIKA
LANDDROSDISTRIKTEKAART
REPUBLIC OF SOUTH AFRICA
MAGISTERIAL DISTRICT MAP**

Okt./Oct. 1972

1:3,000,000

Myl 50 40 30 20 10 0 50 100 Miles
SKAAL SCALE

Landdrostdistriksgrense — Magisterial District Boundaries
Internasionale Grense — International Boundaries
Provinsiale Grense — Provincial Boundaries
Hoofdistrikdorpe — Principal District Towns



The mite *Psorergates ovis*, the cause of sheep itch, enlarged 400 times under the scanning electron microscope



Mycoplasma hyosynoviae was isolated from various lesions. *M. hyopneumoniae*, the cause of virus pneumonia in pigs, could not be isolated.

Research on game and diseases of game

This work was continued in the Kruger National Park. Further serological tests to determine the incidence of brucellosis, were done. The results were as follows:

Species	Number of samples	Number positive	Percentage positive
Buffalo	285	44	16,1
Hippopotamus	99	2	2,0
Human (workers employed in game abattoir)	31	-	-

A cotyledon smear from one of the buffalo was positive for *Brucella* organisms. Meat and synovial fluid samples from the same animal were however negative.

The following serological tests were done for toxoplasma antibodies:

Species	Number of samples	Number positive	Percentage positive
Impala	4	4	100
Hippopotamus	4	4	100
Blue wildebeest	5	4	80
Buffalo	10	7	70
Elephant	20	1	5

No *Toxoplasma* oocysts could be isolated from hyena faeces.

Ninety-five per cent of the elephants examined were infected with the ear mite *Loxamoetus bassoni*. Only the very young calves were free of infection.

Research was started to determine what influence the movements of impala have on the dissemination of foot-and-mouth disease. Twenty-five animals from 8 herds were identified

by means of ear tags. During the dry months there was no mingling of the herds but after the beginning of the rainy season two large herds were formed. Possibly the verified increase in the number of outbreaks during the rainy season can be ascribed to this mixing.

Foot-and-mouth virus has been isolated from pharyngeal scrapings of buffalo. From 45 samples, 19 were positive for SAT I, 15 for SAT II and 6 for SAT III. Some samples yielded all three strains. These samples were taken from buffalo in the northern areas of the Park.

Sarcoptic mange occurred amongst impala, buffalo, blue wildebeest, and lions.

Corynebacterium was isolated from abscesses in impala.

Clinical cases of *actinomycosis* were again found in impala. *Papillomatosis* was again only seen in giraffes.

Lesions caused by *herpes* virus infection were found in the lungs of elephants at the abattoir at Skukuza.

The lungworm *Pneumostrongylus* was common in the lungs of impala. The following liver parasites were also found: *Grammocephalus calthratu*s (adult elephants), *Stilesia hepatica* (impala), *Fasciola* spp. (hippopotamus), *Linguatula* (buffalo) and *Echinococcus* (buffalo).

Various buffalo carcasses were condemned for human use as a result of measles infection. Similarly 17 per cent of buffalo tongues had to be condemned for *Sarcocystis* infection.

VACCINES AND ANIMAL REMEDIES

The following vaccines were prepared by state veterinarians and by the veterinary laboratories:

Heartwater	7 141 doses
Autogenic wart vaccine	20 455 doses
Contagious pustular dermatitis (orf)	1 743 millilitres.

A total of 4 100 ml of *leptospirosis* antigen was made by the Regional veterinary laboratory at Stellenbosch while 861 ml of *Actinobacillus seminis* antigen, 95 ml of *Pasteurella* antigen and 85 ml of *Brucella ovis* antigen were made at Middelburg (Cape). This latter laboratory also made 1 180 ml of an experimental *Actinobacillus seminis* vaccine and 70 ml of an experimental vaccine against *Pasteurella hemolytica*. The laboratories at Middelburg (Cape) and Grahamstown prepared a total of 1 220 ml of complement for their own use.

During the year under review 1 300 doses of different vaccines with a total value of R13 were destroyed by officers of the Division because the expiry date had been reached or the manufacturers' instructions as to storage had not been complied with.

CONTROL OF ANIMAL DISEASES

Notifiable diseases

Foot-and-mouth disease

Three outbreaks of the disease occurred in the proclaimed foot-and-mouth control areas towards the end of the year under review. It was diagnosed in the Barberton district on 14 June 1977 on the farms Elsjan and Albert, the White River district in the Nsigazi area at the following dipping tanks, Spelenyane (14 June), Luphisi (14 June) and Nyamazaan B (30 June) and on the farm Schiettocht in the Letaba district on 25 June 1977. All three outbreaks were caused by the SAT II strain of the virus.

Cattle and small stock on the infected farms and also on surrounding farms were immediately vaccinated with an inactivated bivalent SAT I and SAT II vaccine. A ban was placed on the movement of cloven hoofed animals and their products. Cordons were thrown round the infected areas and additional personnel were brought in to help with the control of the outbreaks and the enforcement of control measures.

In the Kruger National Park suspected cases were found amongst buffalo but were such that samples could not be taken. No such cases were found among other types of game. However, the SAT I, II and III strains of the virus were isolated from pharyngeal scrapings of buffalo north of the Olifants River. Sometimes buffalo cross into Venda and Gazankulu from the Kruger National Park, and thereby increase the danger of an outbreak in those areas. These movements are possibly the result of damage to the fence on the western boundary of the Kruger National Park by floods during the torrential rains which fell in those areas.

The routine precautions to protect farming areas against foot- and- mouth disease were maintained including regular inspection, at short intervals, of animals in the areas bordering on the Kruger National Park and along the boundaries with Botswana, Rhodesia and Mozambique. The boundary fences are regularly patrolled and maintained in good repair by the Division of Veterinary Services. The new part of the international boundary fence between the Republic

and Botswana from Derdepoort to Knowles Park was taken over by the Division on 23 March 1977 for this purpose.

During patrols 54 cattle, 4 sheep and 46 goats were found which had either been illegally smuggled in or had strayed into the Republic or strayed into the Kruger National Park. All the animals with the exception of 34 cattle, sent back to Botswana, were killed and destroyed. An amount of R702 as *ex gratia* compensation was paid to the owners of 3 cattle and 19 goats which had strayed into the Kruger National Park. Thirty four buffalo which had strayed from the Kruger National Park, were shot in Venda and Gazankulu.

During the year 511 745 cattle and 57 434 small stock were inoculated with an inactivated bivalent SAT I and II vaccine in the farming areas bordering on the Kruger National Park, as a preventive measure against foot-and-mouth disease. A similar trivalent vaccine (SAT III added) was used in the northern areas against possible SAT III infection from Rhodesia. A total of 36 993 cattle were inoculated with a bivalent vaccine in Caprivi.

Rabies

Two hundred of the 876 samples (22,9 per cent) sent to the Veterinary Research Institute by the Division and the Homelands during the year were positive for rabies. In the previous year there were 262 (23 per cent) positive cases. The incidence of the disease amongst the different hosts was as follows:

Yellow mongooses	64
Cattle	55
Dogs	43
Species of wild cats	11
Domestic cats	9
Jackals	9
Sheep	2
Goats	2
Skunks	2
Human	2
Horse	1

Rabies appeared for the first time in the Pretoria municipal area. The outbreak was quickly controlled due in part to the ready cooperation of the public.

Natal again had outbreaks along the North Coast. kwaZulu had serious problems in the northern areas. There was an increase in the number of outbreaks in the Rustenburg State Veterinary area. Jackals played an important role as carriers and the infection spread in a south-westerly direction. Towards the end of the year control of jackal numbers contributed to a decline in the number of cases in this area as was the case in the Louis Trichardt and Potgietersrus State Veterinary areas. The cases among humans occurred in the North Western Cape and in kwaZulu.

The rabies unit is still rendering assistance to Venda and Gazankulu. In both areas difficulty is experienced in persuading the local inhabitants to have their dogs immunised. After vaccination

campaigns in these areas 918 un-vaccinated dogs were destroyed by officials of the homeland governments.

Phostoxin tablets were again supplied to eradicate meerkats on farms where an outbreak occurred. Altogether 11 424 tablets were used to treat 305 colonies in the Highveld Region of the Division.

As in the past, dogs in the proclaimed rabies areas of Natal and parts of the Northern and Eastern Transvaal were immunised against rabies. As in the past all dogs and cats within a radius of 15 to 25 kilometres of confirmed cases were inoculated. Altogether 153 966 dogs and 23 564 cats in the White areas and 58 018 dogs and 1 622 cats in the homelands were immunised during the year under review by officers of the Division of Veterinary Services or the respective homelands.

Anthrax

Five outbreaks of anthrax occurred in the Republic during the year under review. Ten cattle and one horse died during these outbreaks.

Altogether 3 879 892 cattle, 250 small stock and 110 horses were preventatively immunised or inoculated during outbreaks in the White areas either by officers of the Division or under their supervision. The corresponding number for the homelands was 2 529 369 cattle.

One case was confirmed in an impala in the Kruger National Park.

East Coast fever and related diseases

East Coast fever (Theileria parva)

No cases have occurred in the Republic since 1954.

A total of 167 950 spleen smears were examined from cattle in the proclaimed East Coast fever control areas in the homelands.

Corridor disease (T. lawrencei)

Three outbreaks occurred one each in the Northern and Eastern Transvaal Region, Venda and Gazankulu. Altogether 116 cattle died of the disease in Gazankulu. All the outbreaks occurred on farms bordering on the Kruger National Park.

Restrictions on the movement of cattle, intensified dipping programmes and the administration of antibiotics were the control methods applied. No cases were found in Natal or kwaZulu. Apparently the completion of the fence surrounding the Hhuhluwe and Umfolozi Game Reserves controlled the movement of buffalo and consequent contact with cattle.

Benign bovine theileriosis (T. mutans)

Eleven cases of this disease were diagnosed in Venda.

Tuberculosis

(Figures for the previous year appear in brackets.)

During the year under review, 2 754 certificates were issued to tuberculosis-free herds (2 510) while 4 830 herds (4 063) took part in the bovine tuberculosis eradication scheme.

Altogether 4 390 (3 742) positive reactors were slaughtered during the financial year ended 31 March 1977. R899 885 (R777 887) was paid in compensation to the owners. Carcases that were not condemned for human consumption were sold for R512 810 (R395 941) and this amount was paid into Miscellaneous Revenue.

The sum of R315 867 (295 130) was paid by the State to 373 (303) contracted private veterinarians in terms of the scheme. A further R28 426 (21 863) for INH (*isoniazid*), eartags and costs not redeemed when positive reactors were slaughtered brought the total outlay with regard to the scheme to R1 244 179 (1 094 881).

Since the scheme was initiated on 14 May 1969, 629 (523) previously infected herds have qualified for tuberculosis-free certificates. There are also an additional 9 heavily infected herds that were treated with INH bringing the total since the inception of the scheme to 58. At the bottom of the next page is a summary of the tests that were done during the year under review.

The incidence of reactors, with the exception of tests on accredited herds was 1,77 (1,93) per cent positive and 1,02 (0,82) per cent suspected.

A further 22 senior members of the stock inspectorate staff were trained to carry out tuberculin tests. The 64 trained officials already play an important part in the expansion of the scheme.

In the various homelands 1 760 cattle were tested with tuberculin. Of these 12 reacted suspiciously.

Tuberculosis in pigs is regularly seen at abattoirs particularly in the Transvaal.

No cases of *tuberculosis in poultry* were reported.

Brucellosis

In pursuance of the brucellosis eradication scheme, 619 782 (75/76 587 135) heifers older than 3 months but not yet 11 months were inoculated with Strain 19 vaccine in the White areas, by or under the supervision of officers of the Division of Veterinary Services.

In the homelands 152 921 heifers were inoculated in this manner.

In cases where infection was confirmed and the State Veterinarian gave written consent for animals older than 11 months to be inoculated, 1 514 females were vaccinated by or under the supervision of officers in the White areas.

Altogether 51 herds have already joined the voluntary accreditation scheme for bovine brucellosis which was initiated on 12 November 1976. A diagnostic scheme was also started on 1 July 1977. Infected animals will in both cases be marked with a C-brand on the right side of the neck.

The following serological tests for brucellosis in cattle were done at State veterinary offices,

veterinary laboratories and regional veterinary laboratories.

Tests	Number of tests	Result	
		Positive	Suspected
Tube agglutination	63 761	7 026	1 754
Complement fixation	8 397	2 268	429
Rose-Bengal	58 766	6 707	-
Total	130 924	16 001	2 183

Of the agglutination tests 10,9 per cent were positive and 4,1 per cent suspected.

A total of 9 132 serological tests were done on small stock. Of these 918 (10,05 per cent) were positive and 436 (4,77 per cent) suspected.

Of 10 292 milk ring tests that were done, 1 462 reacted positively and 25 were suspected.

Brucella abortus was isolated from 37 of 296 cattle foetuses examined in the laboratories of the Division.

Trypanosomiasis

Nagana

No cases of nagana were diagnosed in the Republic.

A few cases occurred in the Caprivi along the Kwando River. Tsetse flies penetrate these areas from Northern Botswana and from small islands in the Kwando River.

It is difficult to give precise numbers of cases because of the difficulty in keeping accurate records. However, the number of cases handled annually remains reasonably constant. It is because of the above invasion that it is not possible to wipe out the disease completely.

The annual spraying campaign by the Division of Veterinary Services keeps the position static. This campaign lasted from the middle of June 1976 to October 1976. Botswana and Angola again did not undertake spraying in the Caprivi tsetse fly complex.

As in the previous year an area of nearly 800 km² was sprayed with 8 000 litres of dieldrin concentrate, as a 3,1 per cent emulsion in water. The total cost of the 1976 campaign was R38 585 as against R26 720 during the previous year. There was again a rise in the prices of insecticides and transport and labour costs.

No collective spraying was undertaken in Mozambique. The Interterritorial Committee for Tsetse Fly Control was again unable to meet.

Dourine

Of the 741 samples sent by the Division to the Veterinary Research Institute, 1,9 per cent reacted positively. If stallions are infected they are castrated or slaughtered. Mares are sterilized or slaughtered.

Lumpy skin disease

Sporadic outbreaks of the disease occurred throughout the Republic. The exception was the Transvaal Region where it was the most important disease of cattle in the year under review. Altogether 349 farms were infected in this Region with a morbidity that varied between three and ten per cent.

The number of outbreaks in the Western Cape Region decreased considerably in comparison with the previous year, as a result of the farmers making better use of the vaccine after the serious outbreaks experienced during that time.

Officers of the Division of Veterinary Services inoculated 54 171 cattle against the disease during the year under review.

Sheep scab

The number of outbreaks of this disease decreased this year to 309 as against 362 the previous year. There were however, outbreaks in 73 magisterial districts and the disease is still a cause for concern.

All Regions of the Division as well as Lebowa, kwaZulu and Bophuthatswana had outbreaks. In the homelands alone there were 61 outbreaks in 7 magisterial districts.

The magisterial districts in which outbreaks were confirmed and the number of cases in each are given below:

Vereeniging 24, Nqutu 21, Boshof 14, Gordonia 14, Brandfort 14, Nkandla 13, Thaba 'Nchu 13, Bultfontein 12, Jacobsdal 11, Bloemfontein 10, Madadeni 9, Fauresmith 7, Westonaria 7, Bethlehem 6, Klerksdorp 6, Potchefstroom 5, Philippolis 5, Kempton Park 5, Brakpan 5, De Aar 5, Hopetown 5, Odendaalsrus 4, Lichtenburg 4, Reddersburg 4, Petrusburg 4, Krugersdorp 4, Middelburg (Tvl) 4, Queenstown 3, Amersfoort 3, Piet Retief 3, Heidelberg (Tvl) 3, Heilbron 3, Parys 3, Viljoenskroon 3, Belfast 3, Seshego 3, Winburg 2, Bothaville 2, Postmasburg 2, Koffiefontein 2, Kenhardt 2, Nigel 2, Roodepoort 2, Johannesburg 2, Vanderbijl Park 2, Sutherland 2, Aliwal North 1, Indwe 1, Victoria West 1, Springs 1, Randfontein 1, Pretoria 1, Carolina 1, Volksrust 1, Wakkerstroom 1, Bronkhorstspuit 1, Dundee 1, Standerton 1,

Test	Number of herd tests	Number of tuberculin tests	Reactions	
			Positive	Suspected
Accreditation	4 997 (3 920)	683 176 (540 284)	-	808 (563)
Diagnostic	391 (358)	15 474 (16 069)	-	49 (77)
Import	34 (90)	255 (1 183)	-	-
Export	97 (108)	5 226 (6 206)	-	1 (1)
INH	105 (49)	21 287 (9 817)	366 (985)	174 (215)
Infected	789 (682)	171 978 (150 350)	3 479 (4 246)	1 127 (1 360)
Total	6 413 (5 207)	897 396 (723 909)	3 845 (5 231)	2 159 (2 216)

Frankfort 1, Balfour 1, Dewetsdorp 1, Excelsior 1, Jagersfontein 1, Fouriesburg 1, Kroonstad 1, Mafeking 1, Theunissen 1, Ventersdorp 1, Welkom 1, Wesselsbron 1, Wolmaransstad 1, Molopo 1, Taung 1.

Speculators and stock sales have once again played a big part in the spreading of the disease. Thirteen of the outbreaks occurred on farms where there were previous outbreaks less than a year ago and where no new sheep had been introduced. The stock had been dipped according to the instructions, so it seems that there were still problems with the dip used. Various firms therefore tested new formulas during the dipping of infected sheep in the year under review.

Altogether 649 873 small stock on infected and contact farms in the Republic were dipped at least twice at 8 to 10 day intervals under official supervision in an approved dip.

Mange

Problems were encountered with cattle mange in the Malmesbury State veterinary area of the Western Cape Region where 12 per cent of the herds were infected. A similar increase in infection was observed in the Standerton State veterinary area. In the Calvinia State veterinary area there were problems with goat mange in the Kenhardt and Namaqualand districts. The mites were mostly found in the ears of the goats. A total of 527 862 goats were dipped during the control of 88 outbreaks.

Many cases of pig mange were reported from the whole Republic. There were again problems in controlling the infection with the available dips.

Swine fever

Classical swine fever does not occur in the Republic.

Two outbreaks of African swine fever occurred during the year both in the proclaimed swine fever area of the Rustenburg State veterinary area. A total of 45 pigs were destroyed during these outbreaks and R560 was paid as compensation to the owners. In both these cases there was previous contact with warthogs or their entrails.

There was no further spread of infection after the infected and contact pigs had been destroyed, sties properly disinfected and movements to and from the infected farms controlled.

In swine fever control areas the same measures were applied as in the past. In White areas there were 575 approved piggeries with 52 715 pigs and in the homelands 32 piggeries with 1 837 pigs.

Swine erysipelas

During the year under review 40 outbreaks were reported in the Republic. All Regions of the Division had one or more outbreaks except the Eastern Cape and Karoo Region.

Treatment with antibiotics and improved hygiene and management control the outbreaks

effectively. Preventive vaccination is also reasonably effective.

Epizootic lymphangitis

No cases were diagnosed during the year under review.

Johne's disease

No cases were reported. Farms on which the disease previously occurred are being carefully watched for further developments.

Infectious laryngotracheitis

No confirmed outbreaks occurred which indicates that the poultry farmers are using the vaccine in the prescribed way.

Rinderpest

This disease does not occur in the Republic.

Newcastle disease

Only the Western Cape Region was free of outbreaks. Seventeen outbreaks were reported from White areas. Most of the outbreaks occurred where the farmers did not follow the recommended vaccination programme. In Natal officers immunised 913 420 fowls against the disease.

This disease occurs fairly generally in the homelands. In Lebowa the vaccination of poultry is compulsory and officers inoculated 345 352 fowls. In Gazankulu 3 472 were inoculated whereas in Venda 189 600 doses of vaccine was sold to farmers by the veterinary services of the homeland.

Bacillary white diarrhoea (BWD) and fowl typhoid

During the year only three outbreaks of BWD were reported, two in the Highveld Region and one in the Western Cape Region. Infected fowls were slaughtered by the owners, regular tests were done, management and hygiene were improved and in this way the outbreaks were controlled.

Fowl cholera

Two outbreaks of this disease were confirmed in Natal.

Psittacosis

No cases were reported. The routine treatment of all imported birds with tetracyclines was continued at the Jan Smuts quarantine station.

Scrapie

No cases were reported.

Equine infectious anaemia

No cases of the disease have occurred in the Republic since 1955.

Glanders

No cases have been found in the Republic

since 1945.

Contagious bovine pleuropneumonia

Since 1924 no cases have occurred in the Republic.

NON-NOTIFIABLE DISEASES

Bacterial diseases

Mastitis

Staphylococcus aureus was again the organism causing most of the problems of mastitis in dairy herds. Twenty nine per cent of the isolations from mastitis milk in the Western Cape Region and 44 per cent in the Highveld Region were *S. aureus*. Other organisms also isolated from such samples were *Pasteurella*, other *Staphylococci*, *Pseudomonas*, *Escherichia*, *Streptococcus* and *Corynebacterium*.

In the Bushveld areas of the country the bitewounds of *Amblyomma* and *Hyalomma* ticks caused problems with udder abscesses. A number of cows had only one or even no unaffected quarters left.

Cases of *blue udder* amongst sheep and goats occurred again in the Western Cape, Eastern Cape and Karoo, Highveld and Free State Regions. *Pasteurella hemolytica* and *S. aureus* were the most common causal agents.

S. aureus also caused mastitis in rabbits in the Western Cape Region.

Improved management and hygiene supported by regular analysis of milk samples, together with the correct use of mastitis remedies, after antibiograms have been done on the samples, can control this disease effectively.

Pulpy kidney (enterotoxaemia)

Cases of this disease occurred sporadically amongst unvaccinated sheep, animals that have been moved on to green feed (before immunity could develop fully), or dosed before immunisation, or where the vaccine was not administered according to instructions.

In the homelands 13 533 sheep were inoculated by officials of the various veterinary services.

Black quarter

Sporadic cases occurred among cattle in all Regions of the Division. There was an increase in the number of cases in the Northern and Eastern Transvaal Region. *Clostridium oedematiens* and *Cl. septicum* together with *Cl. chauvoei* caused cases in the Eastern Cape and Karoo and Northern and Eastern Transvaal Regions.

Cl. oedematiens caused problems in small stock in the Natal and Free State Regions. Considerable problems were experienced in kwaZulu with this disease. It is compulsory to inoculate all cattle between the ages of three months and three years in Venda, Gazankulu and

Lebowa. Officials immunised 246 854 cattle in the homelands.

Botulism

A few cases occurred. In Natal and the Highveld Regions there were deaths among animals in feedlots that had received fowl manure as part of their ration. Fowls, ducks and aviary birds died of botulism in the Vryheid and Mafeking State veterinary areas.

In the homelands 4 804 cattle were immunised by officials.

Corynebacteriosis

This condition occurs commonly in the whole Republic. In the Stellenbosch district a farmer used unsterilised needles to inoculate 143 calves. Within a few days 45 developed *Corynebacterium* abscesses. *C. ovis* caused abscesses among sheep in the Eastern Cape and Karoo Region after the skin had been pierced by the seeds of *Aristida* grass species or after shearing wounds. In the Rustenburg State veterinary area abscesses in the parotis lymph glands of calves caused serious problems. They also caused problems on the Nooitgedacht and Athol Experimental Farms of this Department.

Tick bitewounds are still the most common port of entry of the organism into animals. The correct use of the vaccines alone will not solve problems caused by *Corynebacterium*. General management, hygiene and tick control must also be improved.

Pasteurellosis

This disease was present throughout the Republic. In the Fauresmith, Bloemfontein and Kimberley State veterinary areas the disease reached virtually epizootic proportions. Lambs, particularly, were affected. In the Transvaal Region the disease was widespread and there were also cases among pigs.

Special homologous vaccines had to be made for a feedlot in Rustenburg and a sheep flock in the Stellenbosch State veterinary area before the outbreaks could be brought under control. In the Eastern Caprivi *Pasteurella hemolytica* type B caused a serious outbreak amongst cattle. A homologous vaccine controlled the condition here too. *Pasteurella* organisms were one of the most important causes of blue udder in sheep.

Tetanus (lockjaw)

As in the past a few cases of the disease occurred. In all cases except in the Rustenburg and Calvinia State veterinary areas, lambs were affected after the elastrator had been used to castrate them or to dock tails. In Rustenburg 15 cattle died from tetanus after the animals had been castrated in an unhygienic manner. In Calvinia there was again one case in a horse.

Spores of *Pithomyces chartarum*, the cause of photosensitivity in cattle and sheep (enlarged 450 times)



Colibacillosis

Sporadic cases occurred in the Free State, Eastern Cape and Karoo and Northern and Eastern Transvaal Regions. The incidence of the disease is on the increase in the Highveld Region. Colibacillosis was the disease responsible for the greatest number of deaths amongst newborn calves, lambs and pigs. In the Transvaal Region the disease appeared amongst pigs where the housing was unsuitable and where the feeding was faulty. In the Western Cape Region, *Escherichia coli* was isolated from 25,7 per cent of the samples that were examined bacteriologically by the regional veterinary laboratory at Stellenbosch. This organism, with *Pasteurella*, *Salmonella* and *Chlamydia*, either individually, or together, is responsible for 90 per cent of calf deaths in this Region. Particular attention is being paid to this problem by officers at the laboratory and extension work is being done there. Farmers, and particularly extension officers and veterinarians, are participating in the extension effort.

Leptospirosis

According to available information this disease does not cause many problems.

Vibronic dysentery of pigs

Cases of this disease were only found in the Western Cape Region. From December till April the chronic and subacute form of the disease is often seen. Poor management remains the most important cause of problems. Antibiotics mixed in rations raises production costs and is frequently ineffective because of poor mixing.

Pseudomonas infection

This organism was responsible for mastitis in the Western Cape, Natal and Highveld Regions of the Division. No cases of woolstaining by

Pseudomonas aeruginosa was reported during the year under review.

Actinobacillosis and actinomycosis

A few cases of these diseases were found in the Natal, Free State, Northern and Eastern Transvaal and Highveld Regions.

Actinobacillus equuli was isolated from 4 foals in the Louis Trichardt district.

Foot-rot and foot abscess

A few cases were reported from the Free State, Transvaal and Northern and Eastern Transvaal Regions.

As a result of a lengthened rainy season and a very wet winter, these conditions caused serious problems in the Western Cape Region. During the year under review the occurrence of foot abscess in the Eastern Cape and Karoo Region changed from infection of a single individual to herd infections. The most commonly isolated organism in these cases was *Fusobacterium necrophorum*. *Corynebacterium* also played a role on occasions.

Strangles

A serious outbreak of this disease in the Ceres district could only be controlled after a special vaccine had been made and administered.

"Redgut"

This condition is being further investigated in the Western Cape. *Clostridium perfringens* was isolated from 33 of the 42 cases on which post mortem examinations were done. An experimental vaccine was administered to 3 000 sheep with encouraging results. This investigation also continues.

Lamb dysentery

A few cases of the disease occurred in the

Eastern Cape and Karoo Region.

Listeriosis

No confirmed cases were reported during the year under review.

Protozoal diseases

Babesiosis

Redwater took a heavier toll than usual in the Natal, Western Cape, Free State and Transvaal Regions (especially in the Rustenburg and Piet Retief State veterinary areas). In Natal it was this disease that was responsible for the highest percentage of deaths amongst cattle and it is now also found in the Drakensberg. This occurrence can be partly ascribed to the fact that it was frequently impossible to dip because of the inclement weather conditions. Cases were again found in the Karoo area of the Eastern Cape and Karoo Region. In the Highveld Region there were apparently fewer cases of redwater except in the districts of Marico and Lichtenburg. Above and beyond *Babesia bigemina*, *B. bovis* also made its appearance in the Marico district. *B. bovis* was responsible for 90 per cent of the redwater cases in the districts of Lydenburg and Belfast and it was also the most common parasite in the Ermelo district.

In the Free State the number of cases where babesiosis and anaplasmosis appeared together increased markedly. Except in kwaZulu, where the extraordinary good rains interrupted dipping and led to an increase in the incidence of the disease, it showed its usual pattern in the homelands. In Mhala in Gazankulu 30 cattle died in one outbreak while several recovered after treatment.

Biliary fever in dogs occurred throughout the Republic with a higher than normal incidence in the Transvaal Region. No cases were reported amongst *cats*. A few cases of *biliary fever* in horses were found in the Free State, Transvaal and Eastern Cape and Karoo Regions.

Anaplasmosis

A few cases occurred in the homelands. There were apparently fewer cases than usual in the Northern and Eastern Transvaal and Transvaal Regions. The number of cases is increasing in the Eastern Cape and Karoo (even in the Karoo Midlands) and Western Cape Regions (cases were found at Ladismith for the first time).

Anaplasmosis is the most common disease of cattle in the Highveld Region, especially in the Potchefstroom State veterinary area where problems were encountered if the cases were not treated very soon after the appearance of symptoms.

Only the Upington State veterinary area in the Free State Region remained free of problems with this disease. In Kimberley unusual symptoms of aggressiveness caused diagnostic problems as rabies is also common there. The disease occurred widespread in Natal.

Besnoitiosis (elephant skin disease)

Cases of this disease were found in the Vryburg, Louis Trichardt, Potgietersrus, Rustenburg and Barberton State veterinary areas. The number of cases seems to be increasing in the Barberton district. There were also cases in the Marico district and a few sporadic cases in Lebowa, Gazankulu and Venda. Use of the vaccine has increased considerably in the Northern and Eastern Transvaal, Transvaal and Highveld Regions of the Division of Veterinary Services. It was common in the Eastern Caprivi.

Coccidiosis

Cases of coccidiosis occurred amongst lambs, calves and poultry throughout the country. In the Eastern Cape and Karoo Region the disease was particularly severe amongst both sheep lambs and goat kids on pastures and in vleis. It also caused serious losses amongst lambs (Ermelo State veterinary area), calves (in the Lydenburg district) and fowls (Rustenburg State veterinary area).

Virus diseases

Blue tongue

In contrast to the previous year, there were only serious outbreaks in a few areas of the country. The outbreaks in Northern Natal were caused by a strain of the virus not included in the vaccine. Cases appeared in the Free State Region as early as October and caused serious losses among young lambs. Cases were even found in the middle of winter in the Western Cape Region. The supplementary vaccine which is now available will give wider protection with regard to immunity against the various strains.

African horsesickness

Natal had more trouble with this disease than in the past even in inoculated animals. "Dikkop" horsesickness was a problem in the Louis Trichardt State veterinary area. In the rest of the country there were only a few cases - this differed from the previous year.

Heartwater

This disease took its normal toll in the infected parts of the country. It is now even appearing in some of the sheep farming areas of Natal where it has a limiting effect on sheep farming. It is spreading in a westerly direction in the Mafeking and Molopo districts. Mortality from heartwater remains higher than from any other cattle disease in the Rustenburg State veterinary area. During the year under review the veterinary laboratory in Grahamstown sold more than double the number (7 141) of doses of heartwater vaccine prepared there compared to the previous year.

Three-day stiff sickness (ephemeral fever)

Sporadic cases of the disease occurred. A conspicuous feature of the disease was that animals,

in the Transvaal, Highveld and Eastern Cape and Karoo Regions, took a long time to recover. In the latter Region cases were only reported from the Queenstown and Port Elizabeth State veterinary areas.

Rift Valley fever and Wesselsbron disease

A few outbreaks occurred during the year. In Natal cases were found in the Mtunzini and Lower Umfolozi districts, as well as confirmed outbreaks in the Queenstown and Middelburg (Cape) State veterinary areas.

Bovine malignant catarrh

Cases occurred in the Rustenburg, Pretoria, Mafeking, Lydenburg, Potgietersrus and Bloemfontein State veterinary areas. Contact with blue wildebeest was a factor in all the cases.

Pulmonary adenomatosis (Jaagsiekte)

In the Eastern Cape and Karoo Regions this disease occurred as in the past in Cathcart, Barkly East and Woodhouse. An experimental vaccine is being tested there. The disease appeared at Vorstershoek in the Mafeking district as well as in the Uptington State veterinary area. It was also diagnosed on two farms in the Vryheid district. Eighty sheep died on one of these farms and 60 sheep died on one farm in the Namaqualand district.

Infectious ophthalmia

This disease was widespread but mild in the Highveld and Natal Regions and the eastern part of the Free State Region during the year under review. The incidence in the rest of the country was normal.

Contagious pustular dermatitis (Vuilbek, orf)

There were outbreaks in all Regions. It was widespread in the Eastern Cape and Karoo Region and was frequently complicated by cases of "mulberry foot". The disease reached epizootic proportions in the Marico and Mafeking districts in the Highveld Region. It was also widespread in the Western Cape Region and in the Standerton State veterinary area (especially in autumn).

Mucosal disease

One confirmed case was reported from the Transvaal Region.

Infectious bovine rhinotracheitis

A serious outbreak occurred amongst bulls on the official bull testing station at Irene.

Akabane virus

The presence of this infection in both sheep and cattle in the Republic was confirmed by means of serological tests. It causes deformities and the

so-called hydrancephaly in the foetuses of susceptible ewes and cows. The extent of the problem has not yet been established.

Feline infectious enteritis

Three outbreaks occurred in the Calvinia State veterinary area. All the affected cats died.

Fungal diseases

Ringworm

Sporadic cases occurred in calves in all Regions. Horses were also affected in the Western Cape Region.

Lumpy wool

The heavy rains and lengthy rainy season in the Western Cape Region resulted in several outbreaks at the same time complicating the control thereof. Otherwise only the Eastern Cape and Karoo Regions reported cases.

Streptothricosis (Senkobo)

Infection with *Dermatophilus congolensis* is commonly found in the Eastern Caprivi.

Aspergillosis

Problems with this condition were encountered in imported parrots at the Jan Smuts quarantine station.

Infertility and venereal diseases

Problems with infertility are still being encountered in all Regions of the Division. The most common causes among cattle were poor management, malnutrition and deficiencies. The increasing importance of the role played by venereal diseases is realised. A general phosphate deficiency is causing breeding problems in Natal. A survey to determine the calving percentages in Venda and Gazankulu showed them to be 43,5 per cent and 46,7 per cent respectively. There are various factors which contribute to this, among others the fact that unproductive cattle are not culled and breeding is uncontrolled and continues throughout the year. Other causes are general malnutrition as a result of overgrazing, animals being kept too long in kraals, etcetera.

During the year the AI and Reproduction Section of the Division undertook 30 herd examinations with 9 059 units. In seven of these herds one or more of the venereal diseases were diagnosed.

Vibriosis

This disease was again diagnosed in all the Regions. Out of 87 sheath washings 12,1 per cent in the Louis Trichardt area were infected. Sixteen bulls in the Ermelo and Rustenburg State veterinary areas were found to be infected with vibriosis. The disease was also found in the Lydenburg, Bloemfontein, Queenstown, East

London, Vryheid, Pietermaritzburg and Ixopo State veterinary areas.

Trichomoniasis

The disease was diagnosed in all the Regions except in the Free State and Eastern Cape and Karoo. Problems were encountered in treating bulls in the Rustenburg State veterinary area for this infection as the infection after treatment flared up again. In Vryheid this disease played a more important role than vibriosis. Venda had serious problems with the disease. Samples from 68 bulls were tested. Of these 17, originating from 15 different dipping units, were found to be infected. Of the herds examined by the AI and Reproduction Section, only two were infected with trichomoniasis and two others had a simultaneous vibriosis and trichomoniasis infection.

Chlamydiosis

The incidence of the disease has apparently declined except in the Northern and Eastern Transvaal Region. Considerably fewer abortions occurred but there were problems with the stunting of lambs. *Chlamydia* were isolated from six aborted cattle foetuses at the veterinary laboratory in Kroonstad. There was an outbreak in cattle donated to the Gazankulu homeland.

Actinobacillus seminis

The regional veterinary laboratory at Middelburg (Cape) has isolated this organism from samples from all the Regions except Natal and the Highveld. Of 4 061 rams that were examined in the Western Cape Region, 73 were condemned as a result of *A. seminis* infection. The regional laboratory at Middelburg (Cape) which tested 6 271 rams with the help of the state veterinarian, reports that many breeders lost as much as 20 per cent of their sales rams due to this infection.

Brucella ovis

Infection with this organism was especially common among Dorpers in the Eastern Cape and Karoo Regions. Forty-one rams of the 4 061 examined in the Western Cape Region were infected. The infection was general in the Free State Region, chiefly in those parts that are suitable for sheep farming. This indicates that the Rev. 1 vaccine is not being used sufficiently because this vaccine is very effective.

Infectious epididymitis/vaginitis ("epivag")

This was diagnosed in cattle in the Transvaal, Natal and Western Cape Regions. A survey done on bulls slaughtered at the Durban abattoir indicated that this disease is more widespread in Natal than was realised, especially in the Estcourt State veterinary area.

Mycoplasma was isolated from samples from 63 bulls in the Western Cape Region. Two of the herds examined by the AI and Reproduction Section were infected with "epivag".

Diseases of calves

White scours

Escherichia coli infection again caused calf losses in the White areas throughout the country. Venda also had a few cases. The incidence of the disease remains connected with poor management and hygiene as well as inadequate use of the available vaccine.

Paratyphoid

With the exception of the Natal and Western Cape Regions, there were only sporadic outbreaks with low morbidity and mortality. The practice of buying and raising calves for resale causes problems in the Western Cape. Frequently the calves are not immunised at the prescribed age with the result that there are outbreaks on the farms where they are raised.

Calf diphtheria

A few cases were diagnosed in the State veterinary areas of Potchefstroom, Mafeking and Ermelo. It was diagnosed in goat kids in the Eastern Cape and Karoo Regions.

Sweating sickness

This disease was common in the Northern and Eastern Transvaal Regions and also in the State veterinary areas of Rustenburg and Piet Retief. There were fewer cases than in the past in the Natal bushveld. An imported adult Santa Gertrudis bull developed the disease there. Sporadic cases also occurred in the Vryburg, Fauresmith and Bloemfontein State veterinary areas and in the homelands.

Reovirus

A few cases were confirmed in calves in Natal.

Diseases of poultry

Infectious bronchitis

Sporadic outbreaks of this disease occurred during the year. The use of the Onderstepoort vaccine contributed greatly to the decline in the number of outbreaks. A total of 59 cases were confirmed by the regional veterinary laboratory at Stellenbosch.

Infectious coryza

This disease appeared sporadically in Natal and the Free State Regions. A few cases were diagnosed in the Kroonstad and Potchefstroom State veterinary areas.

Chronic respiratory disease (mycoplasmosis)

Once again there was a decline in the number of cases namely 156, that were diagnosed in the Western Cape Region. The number of cases increased in Natal. It also appeared sporadically in the Highveld and Free State Regions.

Fowl pox

There were a few cases in the following Regions: Eastern Cape and Karoo (along the coast), Free State and Highveld. Only one case was reported from the Western Cape Region. It was widespread in Lebowa.

Gumboro disease

There were five outbreaks in the Western Cape Region amongst three to six week old broilers. The morbidity was high but the mortality was low. Two outbreaks were also confirmed in Natal.

Epidemic tremor

One outbreak was confirmed in Natal.

Marek's disease

Isolated cases of the disease occurred in the Bloemfontein and Mafeking State veterinary areas. Eleven cases were found during post mortem examinations in the Western Cape Region.

Trichomoniasis

A serious outbreak occurred amongst racing pigeons in Mafeking.

Diseases of pigs

The respiratory disease syndrome is of great economic importance in pigfarming in the Western Cape and it is being controlled by the administration of drugs in the rations. The most common organisms that were isolated from lung lesions were *Mycoplasma hyosynoviae* and not *M. hyopneumoniae* which is the most generally accepted cause of the so-called virus pneumonia in pigs.

DEFICIENCY AND NUTRITIONAL DISEASES

Problems with nutrition and deficiencies were not reported to the same degree as in the past.

The regional veterinary laboratories at Middelburg (Cape), Stellenbosch and Allerton are still rendering very valuable services to stock farmers by determining the metabolic profile of cattle, horses and sheep. Allerton is busy drawing up a chart for Natal in respect of trace element deficiencies determined from the analysis of blood and liver samples.

Overgrazing, udder damage by ticks, too much milk taken for human use and too little left for the calves, and veld burning at the end of the winter, have caused malnutrition conditions in the homelands.

A *phosphate* deficiency still plays a very important role, especially in winter in the Highveld, Natal and Free State Regions, as well as in Venda, Lebowa and Gazankulu and the sandy coastal parts of the Western Cape Region.

As in the past a *copper* deficiency in the form of swayback, took its toll in the Malmesbury and Bredasdorp districts. The condition occurred in sheep and oryxes. Springbuck growth was retarded due to copper deficiency. This deficiency appeared in the Eastern Cape and Karoo Region, and in the coastal areas with a high rainfall. There was also a copper deficiency in the Louis Trichardt State veterinary area.

A *magnesium* deficiency caused deaths on green grazing in the Malmesbury State veterinary area and also in the Free State and Natal Regions. Cattle were affected in the Queenstown and Louis Trichardt State veterinary areas and in the Maclear district.

Manganese deficiency caused problems in ostriches in Oudtshoorn and also in the Knysna and Malmesbury districts. There is apparently a general *iodine* deficiency in the Natal Midlands. A *zinc* deficiency was also found in large parts of Natal differing from the Louis Trichardt State veterinary area where there is a particularly high level of this element.

A *cobalt* deficiency was diagnosed during the year under review, in the Humansdorp district only.

Vitamin B deficiency caused deaths amongst chickens in the State veterinary areas of Queenstown and Kroonstad. *Vitamin E* deficiency caused problems amongst chickens in the Queenstown, Bloemfontein and Upington State veterinary areas. Deaths from encephalomalacia were usually due to the above-mentioned deficiency.

Two month old calves at the Nooitgedacht Research Station became paralysed and developed a diarrhoea. During post mortem examinations typical white muscle disease was diagnosed.

There were a number of cases of *pregnancy toxemia* (domsiekte) (before lambing) in the Western Cape Region and in the Ermelo State veterinary area in sheep that were moved after shearing. There were also a considerable number of cases in the Eastern Cape and Karoo Region.

Milk fever occurred in ewes in the Western Cape Region shortly before they were due to lamb.

There were a few cases of *acidosis* in the Mossel Bay State veterinary area. In Natal oxen, run on star grass pastures and receiving mealies as a supplementary feed, developed acidosis. Problems with acidosis were also encountered in feedlots in the Free State Region.

POISONING

Mineral poisoning

Cases of mineral poisoning were reported from all over the Republic, mostly as a result of carelessness or accidental intake of the poison.

There were only a few cases of *arsenic* poisoning during the year, these being reported from the Wodehouse, Aliwal North and Queenstown districts and there was one case in the Bloemfontein State veterinary area. Twelve cattle were poisoned in Mokerong in Lebowa.

A *chlorinated hydrocarbon* dipping agent was responsible for the death at Mafeking of five calves

younger than three months when they were dipped. Through the use of the wrong concentration of a dip several calves and dogs were poisoned and they had to be treated by the State Veterinarian at Mossel Bay.

An *organophosphatic* insecticide caused the death of eight cattle in Mafeking, when it was used as a dip. There 13 chickens also died after eating army worms that had been sprayed with an organophosphate. Two hundred sheep in the Vryburg State veterinary area and 26 cattle in the Louis Trichardt district died of organophosphate poisoning because the dip used was too concentrated. Deaths among cattle also occurred in Potchefstroom. Follidol caused the death of 12 cattle after they had been handdressed with it. A too concentrated solution of Batestan killed five out of nine cattle sprayed with it.

Dieldrin caused deaths among cattle in Viljoenskroon and among dogs in Natal.

An *amitraz* dip caused poisoning and deaths in horses at Hluhluwe and Mkuze. Similar cases occurred in the Transvaal Region.

Toxaphene caused deaths in the Natal Region. After dipping in *diazinon*, 110 Angora goats from a flock in the Western Cape Region, died.

The wrong dose of *Ranide* caused the death of nine sheep and blinded 30 others on two farms in the Highveld Region. Three valuable stud bulls died in the Western Cape Region after eating oats that had been treated with phenaminosulphate.

Nitrate poisoning killed 28 cattle in the Highveld Region after limestone ammonium nitrate had been put in the drinking water. Abnormally high concentrations of nitrates in the drinking water were responsible for the death of 63 cattle in the Kuruman district. A nitrate concentration of 1655 ppm in the drinking water in the Louis Trichardt State veterinary area caused poisoning in a number of cattle and eight died in spite of treatment.

Salt poisoning was responsible for the death of 25 pigs and 10 sheep in the Transvaal Region.

Urea caused deaths in all the Regions. In Steinkopf urea was sold as watersoluble phosphate for addition to the drinking water. It caused the deaths of 155 sheep and goats. In Natal 86 cattle died after their drinking water had been polluted by the effluent from a mine. Urea and iron were present in the water in excess. Urea poisoning was the most common form of poisoning in the Free State Region.

Enzootic icterus (chronic copper poisoning) occurred in the Eastern Cape and Karoo and Western Cape Regions. Cases were also found in the Northwestern Free State. In the first named Region there were 22 outbreaks during which 842 sheep died. Problems also occurred in fat lambs from the Karoo transferred to feedlots in the Western Cape. The administration of molybdenum compounds is of value in treating the condition.

Twenty sheep out of 40 died of copper poisoning after eating a snailbait containing copper, which had not been removed from their camp. The

use of injectable copper compounds also caused cases in the Western Cape.

In the Western Cape a railway truck that had contained lucerne, was swamped out. The sweepings caused *lead poisoning* in 14 cattle when they were fed to them. The lucerne sweepings contained 670 ppm of lead.

In Pitketberg the high mineral content of the drinking water caused all 200 ram lambs in a flock to develop bladder stones.

There were fewer cases than usual of *strychnine poisoning*. Fifteen goats died of this at Van Rhynsdorp.

Plant poisoning

According to reports from the Regions and the homelands the following plants caused stock deaths:

Homeria and *Moraea* spp. (tulp) in all seven Regions; *Senecio* spp. (sprinkaanbos) in all the Regions with the exception of Transvaal and Northern and Eastern Transvaal; *Pachystigma*, *Pavetta* and *Fadogia* spp. (gousiekte) in the Natal (Glencoe and Dundee districts), Northern and Eastern Transvaal (Lydenburg, Potgietersrus and Louis Trichardt State veterinary areas) and Highveld Regions and in Lebowa; *Crotolaria* spp. (duinebos) in the Highveld (*C. burkeana* especially in the Marico district) and Free State Regions and Lebowa (Seshego and Bochum); *Dichapetalum cymosum* (gifblaar) in Bophuthatswana, Lebowa and the Transvaal (Rustenburg State veterinary area) and Northern and Eastern Transvaal Regions (Potgietersrus State veterinary area); *Geigeria* spp. (vermeerbos) in the Highveld and Free State Regions (Western part); *Urginea* and *Ornithoglossum* spp. (slangkop) in the Highveld (Potchefstroom State veterinary area) and Free State Regions; *Cotyledon* spp. (krimpsiekte) in the Eastern Cape and Karoo and Western Cape Regions (Calvinia State veterinary area); *Cynanchum* spp. (klimop bobbejaantou) in the Highveld and Western Cape Regions (Mossel Bay State veterinary area); *Lantana camara* and *Datura* spp. (among horses) in the Transvaal Region; *Tribulus* spp., *Ornithogalum* spp. (chinkerinchee); *Kalanchoe* spp. *Asaemia axillaris* (vuursiekte); *Sarcostemma viminale* (climbing milkweed); *Galaenia africana* (waterpens); *Cadaba aphylla* (swartstorm) (Mossel Bay State veterinary area); *Anagallis arvensis* and *Rumex angiocarpus* (both in the Mossel Bay State veterinary area) in the Western Cape Region; *Chrysocoma tenuifolia* (bitter Karoo) in the Central and Southwestern Free State; *Matricaria* spp. (staggers) (the Natal Midlands - 40 cattle died in one outbreak) and *Cestrum laevigatum* (inkberry) along the Natal coastal regions; *Melianthus major* (honey flower) and *Lasiospermum* spp. (ganskweek) in the Eastern Cape and Karoo Region.

A few cases of *geeldikkop* occurred in the Free State Region.

Plants containing *prussic acid* caused deaths in the Eastern Cape and Karoo, Highveld, Natal and Free State Regions.

Acorns caused deaths in cattle at Ermelo.

Deaths occurred among cattle in Natal and the Transvaal Regions after grazing on Kikuyu pastures that had been previously infected with army worms. Just as in the rest of the world the cause of this could not be established.

Toxins

Diplodia maydis poisoning occurred in the Highveld (23 cattle died on one farm in the Potchefstroom district), and Transvaal Regions.

Cases of *lupinosis* were found in the Malmesbury State veterinary area as well as *ergot* poisoning in the Knysna district.

Mouldy hay caused the death of 119 sheep at Alexander Bay. Mouldy feedcakes took their toll in Natal.

INTERNAL PARASITES

As a result of the favourable climatic conditions internal parasites again caused unusually high losses amongst cattle in the Western Cape and Highveld Regions. There were however, fewer problems in the Transvaal and Free State Regions than in the previous year.

Haemonchus spp. (wireworm) was the most common cause of problems in the Eastern Cape and Karoo, Free State and Transvaal Regions. In the Southeastern Transvaal a definite resistance amongst wireworms to certain remedies has been established. In the Highveld and Natal Regions they were one of the two most common internal parasites and in Lebowa, Bophuthatswana, Venda and Gazankulu wireworms were the most common parasite.

Oesophagostomum spp. (nodular worm) was, together with wireworm the most important internal parasite in the Highveld and Natal Regions. There were also heavy infestations in the Western Cape and Free State Regions, and in Lebowa, Venda and Gazankulu (especially in small stock).

Trichostrongylus spp. (bankrupt worm) was prominent in the Eastern Cape and Karoo, Highveld, Free State and Western Cape Regions. Eight eland died in a nature reserve at Klerksdorp as a result of bankrupt worm infestation.

Trichuris ovis (whip worm) caused problems in the Bethlehem State veterinary area and the Free State Region.

In Natal the incidence of the brown stomach worm (*Ostertagia* spp.) was comparable to that of wireworm and nodular worm. The long-necked bankrupt worm (*Nematodirus* spp.) and the brown stomach worm caused losses in the Western Cape and Eastern Cape and Karoo Regions.

Strongyloides spp. caused deaths in calves in Gazankulu during the year under review.

Muellerius capillaris (lung worm) was responsible for problems in the Western Cape Region and for the first time in years reappeared in the following districts, Wodehouse, Tarkastad and Barkly East.

Schistosoma spp. (bilharzia) once again caused deaths amongst small stock in the district Mokerong in Lebowa.

Paramphistoma spp. (conical fluke) was widespread, appearing among other places in the following districts, Molteno, Middelburg (Cape), Ceres, Tulbagh, Bethlehem, Mafeking and the Standerton State veterinary areas were also affected. Problems were encountered in the Natal (Zululand) and Free State Regions.

As was the case with conical fluke, liver fluke (*Fasciola* spp.) was widespread in the Western Cape especially in the Ceres and Tulbagh districts, and in the Eastern Cape and Karoo Region in the Molteno district. The whole Highveld Region (with a lower incidence in the Mafeking State veterinary area), Southern Natal, East Griqualand, the Vryheid, Lydenburg and Bloemfontein State veterinary areas and also Venda and Gazankulu, were afflicted by this parasite. The incidence is on the increase in the Transvaal Region.

Young calves were infected with *tapeworms* in the Eastern Cape and Karoo, Western Cape, Free State and Northern and Eastern Transvaal Regions as well as in Bophuthatswana and Lebowa. It caused losses among lambs in these areas and also in the Transvaal and Natal Regions and kwaZulu.

Stilesia hepatica (liver tapeworm). The incidence of this parasite remains static in the Free State Region. Most of the livers condemned for human consumption during meat inspections in the Northern and Eastern Transvaal Region are condemned because of infestation by this parasite. The Eastern Cape and Karoo Region has also encountered problems with it.

Oestrus ovis (nasal worm) infestations occurred in the Highveld (Mafeking State veterinary area), Western Cape and Free State Regions.

Measles caused two per cent of the animals slaughtered for human consumption in the Free State Region to be condemned outright or to be frozen. In the Transvaal Region 3 000 carcasses per month are condemned upon inspection as a result of measles infestation. As in the past, it still causes problems in the Northern and Eastern Transvaal Region.

The incidence of *Parafilaria bovicola* in cattle is increasing in the Natal Bushveld and in the infected areas of the Transvaal Region. It is widespread in Gazankulu.

EXTERNAL PARASITES

Ticks increased in numbers everywhere due to the favourable weather conditions which resulted in a severe incidence of tick-borne diseases and an increase in the number of abscesses and cases of tick toxicosis. This was particularly noticeable in kwaZulu where the torrential rains interfered with normal dipping.

Boophilus spp. (blue tick) was active in the Highveld, Western Cape (in the Sandveld and the mountainous parts), Natal and the Free State Regions.

Rhipicephalus appendiculatus (brown ear tick) caused a lot of problems in Gazankulu, the Highveld (especially Potchefstroom State veterinary area), Natal, Free State, Transvaal and Northern and Eastern Transvaal Regions.

R. evertsi (redlegged tick) was widespread in the Free State Region and the Port Shepstone district.

Hyalomma spp. (bontlegged tick) appeared in large numbers in the Free State, Transvaal, Natal and Western Cape Regions.

Ixodes rubicundus (Karoo paralysis tick) once again caused losses in the Free State Region and in the Calvinia State veterinary area.

Sheep lice infestations were found in all the Regions. The parasite was also very common in Lebowa and Gazankulu. Both *Damalinia ovis* and *Linognathus pedalis* were found in the Western Cape Region.

Cattle lice infestation was reported from the Free State Region.

Sheep ked (*Melophagus ovinus*) caused problems in the Highveld (particularly Bethlehem State veterinary area), Eastern Cape and Karoo and Natal Regions and in Lebowa. The incidence of the parasite is on the increase in the Southern Free State, while no infestation was reported this year from the Calvinia State veterinary area.

Infestation with *Psorergates ovis* (Australian itch mite) was identified in the Western Cape and Natal Regions.

Blowfly strike caused trouble in the Transvaal (Rustenburg State veterinary area), Eastern Cape and Karoo, Western Cape (signs of resistance against available remedies were again found in Riversdale) and the Free State Regions (less than usual).

Mosquitoes were less of a pest in the Western Cape (except in and around Brandvlei) and the Free State Regions than in the previous year.

Gnats and midges followed the same pattern as the mosquitoes. Their numbers started to build up along the Orange and Vaal Rivers but because the level of the water was artificially controlled by opening or closing sluice gates, the pest was controlled to a great extent.

Stomoxys spp. (stable flies) were particularly troublesome in the coastal areas of Natal.

Demodex infection of dogs was diagnosed in the Queenstown State veterinary area and in Lebowa and Venda. Treatment with amitraz yielded good results in Venda.

ARTIFICIAL INSEMINATION

Testing of bulls at the AI centres in Natal and Western Cape was done, as before, by the regional veterinary laboratories at Allerton (for Natal) and Stellenbosch (for the Western Cape). All other bulls were again tested by the AI and Reproduction Section of the Division of Veterinary Services. The final recommendation regarding the registration or re-registration of AI bulls depends on this Section after all the results have been correlated. During the year 176 bulls were tested for this purpose. None of the bulls reacted

positively to tests for vibriosis or trichomoniasis. One bull reacted positively for brucellosis during testing before registration. Another bull gave a positive reaction to a test for *Leptospira pomona* infection. These bulls were not registered as AI bulls. There are 166 bulls of 18 breeds at registered AI centres. Dairy breed bulls still constitute 60 per cent of the total number of bulls. One new AI centre was approved and registered during the year under review. The total number of doses of semen sold by AI centres during 1976 was approximately 644 222 (603 000 in 1975).

During the year under review the AI and Reproduction Section offered two courses for persons wishing to become registered inseminators. Out of 32 candidates only one failed. The State Veterinarian at Potchefstroom ran two such courses for 28 candidates at the Potchefstroom College of Agriculture (27 passed). At both courses officers of the AI and Reproduction Section acted as external examiners.

Altogether five courses for owner-inseminators were held and 73 farmers passed. During three courses for Non-Whites 41 passed and they can now inseminate their own stock or those of their full-time employers.

A total of 95 cattle farmers attended nine courses at the Potchefstroom College of Agriculture. Two courses were also offered for 12 sheep farmers. At the Glen College of Agriculture the Bloemfontein State Veterinarian held three courses for 60 farmers during which artificial insemination in sheep was also dealt with.

Various courses for farmers wishing to inseminate their own stock, were offered by State veterinarians. The State Veterinarians of Vryburg held a course for 12 farmers. The Pietermaritzburg State Veterinarian trained 24 cattle farmers during two courses at Cedara. At the Elsenburg College of Agriculture three courses for 43 cattle farmers and two for 60 agricultural students were offered, while at the Kromme Rhee Training Centre for Coloured farmers and workers, one course for seven participants was offered.

During the year under review, 12 108 doses of bull semen and 25 doses of horse semen were imported.

STOCK INSPECTION SERVICES

The serious shortage of stock inspectors has once again increased. The number of experienced stock inspectors is constantly decreasing and there is a high turnover among the younger men.

ANIMAL HEALTH EXTENSION SERVICE

The scope and effect of extension to farmers by officials of the Division of Veterinary Services, is continually increasing. Apart from the Division's contribution to the training of farmers at Agricultural Colleges, the compiling of leaflets, etc. the following extension tasks are also undertaken:

Farmers' days are arranged and addressed, articles are published in local papers and agricultural journals, farmers' unions and study groups are addressed, radio talks are compiled, short courses on animal diseases (prevention and control) are offered and dosing and inoculation programmes are drawn up.

Individual farmers are advised by State veterinarians and stock inspectors on their individual farm and disease problems, improved stock farming methods and the advantages to be gained by participating in schemes such as the bovine tuberculosis and brucellosis eradication schemes. This information is given during farm visits, office consultations, by telephone or by letter.

IMPORT AND EXPORT CONTROL

Import control

Constant vigilance against the introduction of diseases from other countries is exercised. To this end there are quarantine stations at Jan Smuts Airport, Durban, Cape Town and Walvis Bay.

As can be seen from the following table, there is a large variety of animals imported for slaughter, farming or other purposes.

Cattle	2 271
Horses	279
Sheep	920
Goats	591
Pigs	56
Dogs	1 509
Cats	547
Poultry	35 858
Birds	28 878
Rabbits	7
Game	40
Zoo animals	15
Tropical fish	176 290
Reptiles	127
Rodents	225
Primates	1 186

The following animals were illegally imported through Jan Smuts Airport: one parrot and five bantams. The quarantine master seized all six and they were later destroyed and burnt.

A large variety of products were also imported under permits issued by the Division. The following were however, found to be without the necessary permits at Jan Smuts Airport and were confiscated and burnt: three kilograms of biltong and 19 kilograms of fresh meat.

Export control

For export purposes permits were issued by officers of the Division in accordance with the requirements of the importing country in respect of the following animals:

Cattle	52 043
Equines	1 334
Sheep	26 577
Goats	4 751
Pigs	413
Dogs	2 079

Cats	463
Poultry	2 159 183
Hatching eggs	1 621 632
Birds	23 475
Wild animals	94
Rabbits	16
Reptiles	434
Fish	70
Marine animals and birds	36

A large variety of products were also certified by officials of the Division for export purposes.

TRAINING

Veterinary Science was again taught in all the Agricultural Colleges by State veterinarians of the Division. A standardised set of lectures for use by all the colleges is now reaching completion and will hopefully be available during the coming year.

The formal in-service training of members of the stock inspectorate staff was continued. Altogether 41 officials were trained during two courses. This brought the total number trained since 1972 to 496. These officers now render more efficient service both to the farmers and to the Division.

The training of members of the stock inspectorate staff to do tuberculin tests under the bovine tuberculosis eradication scheme was continued during the year under review when 22 officers attended a course. There are now 64 officers trained in this manner. They are already rendering a big contribution to the expansion of the scheme.

LEGISLATION

The following government notice under the *Animal Disease and Parasites Act, 1956* (Act 13 of 1956) was published during the year under review.

Government Notice 1360 of 13 August 1976 - "Restrictions on the movement of cloven-hoofed animals and products."

CLINICAL SERVICES

Veterinary services were once again rendered to all State-owned herds and flocks by State veterinarians; clinical services were rendered to farmers when the official duties of the State veterinarians permitted. This applies particularly to areas where there are no private veterinary practitioners.

During the year the amounts of R18 199 for professional services and R9 329 for travelling expenses were collected by State veterinarians. Vaccines to the value of R5 179 were sold by State veterinary offices, R22 677 was collected for laboratory fees and R332 347 for services rendered at export abattoirs. Income from the quarantine of animals and birds was R13 595 and sundry revenue was R2 650. The Division received R512 810 for carcasses of cattle slaughtered in accordance with the bovine tuberculosis eradication scheme but passed for human consumption. The total income

received by the Division of Veterinary Services was R916 786.

Distribution of cattle

Region or homeland	White owners		Non-White owners	
	White areas	Non-White areas	White areas	Non-White areas
Western Cape	387 176	-	5 129	-
Eastern Cape and Karoo	1 001 934	-	38 338	-
Transvaal	2 080 357	-	186 564	-
Natal	1 293 404	-	258 880	16 614
Free State	946 087	-	8 079	-
Highveld	2 143 618	-	88 475	5 948
Northern and Eastern Transvaal	1 133 099	-	22 674	69 724
Total	8 985 675	-	608 139	92 286
Venda	-	-	-	127 180
Gazankulu	-	-	-	144 267
Lebowa	-	429	-	495 104
kwaZulu	-	-	-	1 348 841
Qwaqwa	-	243	-	11 915
Bophuthatswana	-	-	-	502 273
Ciskei	-	-	-	176 980
Total	-	672	-	2 806 560
Grand total	8 985 675	672	608 139	2 898 846

DIAGNOSTIC SERVICES

Apart from the diagnostic services rendered by the State veterinarians in their own areas, the Division has four regional laboratories at Allerton, Middelburg (Cape), Stellenbosch and Windhoek as well as smaller veterinary laboratories at Grahamstown, Kroonstad, Queenstown and Grootfontein (SWA). A laboratory at Skukuza enables the Division to keep its finger on the pulse of animal health in the Kruger National Park.

Apart from the supportive service that the above laboratories render to State veterinarians and private veterinarians, they play an ever increasing part in extension. The extension is mostly based on the latest local findings and is therefore acceptable to the local farmers. The demand for lectures by laboratory officials at farmers' days, meetings, etcetera is increasing steadily.

The following diagnostic services were rendered by State veterinarians of the Division (in the Republic):

<i>Brucella</i> agglutination tests	63 761
<i>Brucella</i> complement fixation tests	8 397
<i>Brucella</i> Rose Bengal tests	58 766
FA tests	1 038
PPLO tests	17 153
BWD tests	818
HI tests	8 371
Vibriosis	1 049
Trichomoniasis	493
John's Disease	12
Leptospirosis	522
<i>Actinobacillus seminis</i>	47 271
Pasteurellosis	831
Chlamydiosis	669
<i>Chlamydia</i> -isolations	110
Antibiograms	802
Serotyping of cultures	93
Skin scrapings	876
Faeces examinations	20 051
Identification of internal parasites	737
Identification of external parasites	34
Mastitis milk examinations	4 894
Semen	10 372
Sheath washing	1 156
Vaginal swabs	1 351
Aborted foetuses	344
Haematology	1 722
Biochemical	48 027
Toxicological	490
Bacteriological	15 855
Virological	2 955
Biological	2 057
Histopathological	1 310
Abattoir by-products tested	18
Trichinella	34

Stock census

Region or homeland	Cattle*	Sheep		Goats	Horses	Donkeys and Mules	Pigs	Fowls	Dogs
		Woolled	Non-woolled						
Western Cape	392 305	3 080 568	1 417 358	442 011	19 238	9 360	243 419	6 017 689	55 378
Eastern Cape and Karoo	1 040 272	7 488 621	1 477 656	1 287 434	30 721	10 625	81 150	2 767 896	73 326
Transvaal	2 266 921	2 638 947	263 040	90 345	38 800	7 948	246 243	9 065 375	419 614
Natal	1 568 898	945 432	79 594	133 318	29 157	5 533	156 810	12 725 969	76 111
Free State	954 166	67 173	3 694 574	443 800	16 721	10 928	33 395	308 570	36 746
Highveld	2 238 041	2 737 833	402 474	61 462	57 897	4 104	242 097	3 654 443	136 684
Northern and Eastern Transvaal	1 225 497	246 830	158 166	121 613	7 346	11 726	96 132	1 257 397	41 444
Total	9 686 100	17 205 404	7 492 862	2 579 983	199 880	60 224	1 099 246	35 797 339	839 303
Venda	127 180	-	2 649	45 019	12	8 478	11 475	42 473	13 966
Gazankulu	144 267	-	2 996	49 996	11	5 489	10 971	64 170	16 925
Lebowa	495 533	234	85 956	375 374	193	29 280	26 561	379 163	29 463
kwaZulu	1 348 841	56 983	106 767	603 893	13 197	29 356	32 178	996 709	93 297
Qwaqwa	12 158	5 777	400	14 080	258	2 021	55	10 976	1 056
Bophuthatswana	502 273	**	207 670	430 853	10 904	46 122	12 328	22 307	236 499
Ciskei	176 980	205 775	**	170 626	5 463	835	15 025	141 276	15 328
Total	2 807 232	268 769	406 438	1 689 841	30 038	121 581	108 593	1 657 074	406 534
Grand total	12 493 332	17 474 173	7 899 300	4 269 824	229 918	181 805	1 207 839	37 454 413	1 245 837

*Please refer to next table for analysis of cattle figures.

**Sheep not divided into woolled and non-woolled

Smears	22 549
Clinical examinations	33 625
Post mortems (Poultry excluded)	4 639
Poultry post mortems	3 662
Poultry specimens examined	3 968

Total	390 877
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In the Homelands a total of 33 post mortems on other animals and 52 on poultry were performed, and 130 blood, brain and organ smears, 24 skin scrapings, 175 faeces specimens and 68 sheath washings were examined.

MEAT HYGIENE

Administration

Abattoirs

There are at present 1 114 abattoirs in the Republic of South Africa in possession of a valid certificate of approval issued by the Division of Veterinary Services. Of this total 274 are in the homelands, 884 are red meat abattoirs, 209 poultry abattoirs and 21 rabbit abattoirs.

The grading of abattoirs takes place as follows:

Grade A - 101 cattle units and more per day

Grade B - 11 to 100 cattle units per day

Grade C - up to 10 cattle units per day

Grade D - two cattle units per day with a maximum of five per week.

The above is applicable to red meat abattoirs where cattle, sheep, goats, pigs and equidae may be slaughtered.

Grade E - poultry abattoirs - where 50 and more per week may be slaughtered.

Grade K - rabbit abattoirs.

Distribution of abattoirs with valid certificates of approval:

Region or Homeland	A	B	C	D	E	K
Transvaal	11	12	34	25	46	8
Northern and Eastern	2	10	27	48	7	2
Transvaal						
Highveld	4	10	32	18	31	-
Free State	2	4	39	43	27	-
Natal	4	9	24	27	45	5
Eastern Cape and	2	10	43	37	15	2
Karoo						
Western Cape	3	10	63	57	38	4
kwaZulu	-	-	1	65	-	-
Bophuthatswana	-	-	3	41	-	-
Lebowa	-	-	11	99	-	-
Venda	-	-	-	30	-	-
Gazankulu	-	-	1	23	-	-
Total	28	65	278	513	209	21

During the year under review the following 28 red meat, 21 poultry and three rabbit abattoirs ceased operating for various reasons and their certificates of approval were cancelled:

Province	Red meat	Poultry	Rabbit
Transvaal	8	4	2
Free State	1	3	1
Natal	6	10	-
Cape	13	4	-

During the same period certificates of approval were issued to 57 red meat, 57 poultry and three rabbit abattoirs with the following distribution:

Region or Homeland	A	B	C	D	E	K
Transvaal	2	-	1	5	8	1
Northern and Eastern	-	-	-	12	4	-
Transvaal						
Highveld	-	-	1	1	12	-
Free State	-	1	1	-	11	-
Natal	-	-	-	-	7	2
Eastern Cape and	-	-	1	3	7	-
Karoo						
Western Cape	-	-	1	2	8	-
kwaZulu	-	-	-	7	-	-
Bophuthatswana	-	-	-	2	-	-
Lebowa	-	-	1	10	-	-
Venda	-	-	-	5	-	-
Gazankulu	-	-	-	1	-	-
Total	2	1	6	48	57	3

In accordance with the provisions of section 20(1) of Act 87 of 1967 subsidies amounting to R216 341 were paid to 37 local authorities on the salaries of 128 meat inspectors employed by them.

Sterilisation installations

At present there are 69 registered sterilisation installations in the Republic, two new installations having been registered during the year under review.

These installations produce fishmeal, carcase meal, bloodmeal, bonemeal, fish oil and tallow. They are at present inspected at least once a year by State veterinarians for registration purposes. Monthly samples for bacteriological monitoring were taken during the year at the abattoirs where the Division supplies meat inspection services.

Planning

During the year there was a tremendous increase in the number of new abattoirs being planned as well as structural improvements to existing abattoirs.

In accordance with the provisions of section 18 of Act 87 of 1967 the Division of Veterinary Services examined 225 sets of plans and drawings of abattoirs and factories for comment and recommendations.

Meat imports

There was a shortage of low grade industrial meat which had to be augmented by the importation of deboned meat from Botswana, Rhodesia and Swaziland. One consignment originated from Australia.

Meat exports

There was a sharp decline in the amount of meat and meat products exported.

An increase in the export of venison occurred during the year. This necessitated the formulation of a set of minimum requirements in respect of the

standard of hygiene to be conformed to during game cropping and the subsequent handling of carcasses. Altogether 763 262 kilograms of venison as well as the carcasses of 585 blesbuck, 3 433 springbuck and 24 oryxes were exported.

Legislation

During the year the following Government notices were published under the *Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967)*.

Government Notice 1359 of 13 August 1976 - Exclusion of certain areas where animals are slaughtered from the provisions of the Act.

Government Notice 346 of 11 March 1977 - Exemptions in respect of slaughter for certain purposes.

Notice 207 of 1 April 1977 - Granting of exemptions to certain abattoir owners, operators or persons.

Notice 208 of 1 April 1977 - Amendment of exemption in respect of Durban abattoir.

Government Notice R537 of 7 April 1977 - Amendment of Regulations.

Meat inspection services (departmental)

The Division provides meat inspection services at abattoirs which belong to or are managed by the Abattoir Commission, as well as at privately owned abattoirs approved as export establishments.

There was an improvement during the year in the shortage of inspectorate personnel brought about by recruiting and training.

At present meat inspection is only performed at approved export poultry abattoirs when slaughtering for an export consignment.

The Division is, however, planning to provide full-time hygienic supervision of the larger poultry abattoirs, which will lead to a considerable increase of the meat inspectorate personnel.

Considerable progress has been made in improving of hygiene at all the abattoirs under the Division's control. The owners were encouraged to improve hygiene voluntarily. Legal action was only taken in cases where the requirements in respect of hygiene could have been complied with through improved management or at minimum cost, and this was not done. Where the cost of rectifying structural deficiencies was very high, exemption was granted to those concerned, provided they applied for it.

The number of abattoirs where exemptions were granted or are in the process of being granted were Transvaal 24, Free State 26, Natal 15 and the Cape Province 28.

RESEARCH ON GRAZING UTILISATION

NATURAL GRAZING

Although the rainfall was lower during the

year under review than during the previous year, grazing conditions were generally favourable. Accidental fires remained a problem and reports of severe damage were received from the Free State and Karoo Regions, but farmers were fortunately better organised and prepared to deal with veld fires.

There were outbreaks of armyworm in several Regions and a great deal of damage was done to the natural grazing.

Controlled selective grazing

The extensive production of beef on natural grazing in the sourish mixed Bushveld was investigated on the Soutpan Experimental Farm in accordance with the principles of controlled selective grazing and improved herd management. Africander-type cattle were used initially, but breeders later changed over to criss-crossing between Simmentalers and Africanders. There were dramatic improvements in calving percentages (from 56% to 86%) and weaning masses (from 144 kg to 192 kg). During the last seven years meat production (live mass) was increased from 17,9 to 30,5 kg/ha and the herd turnover from 17% to 40%, notwithstanding the fact that the average annual number of large stock units on the farms dropped by as much as 23% in some cases.

The application of the principles of controlled selective grazing over a period of eight years on sourveld at Athole led to a marked decrease in undesirable species and an increase in palatable species. The productivity of the veld and the length of the grazing season were increased in this way.

Intensive observations on the response of key species to various defoliation régimes revealed the reason why certain palatable grasses have virtually disappeared from the ordinary sourveld composition, namely their sensitivity to short and repeated defoliation.

There were preliminary indications on Döhne sourveld that, with controlled selective grazing where a 12-camp system is applied, veld produces practically a 20% increase in body mass and a 40% increase per animal, in comparison with the conventional 4-camp system. Observations on the rate of regrowth indicate that the optimum is a grazing period of about 10 days per camp, followed by a resting period of between 60 and 84 days.

Order of selection

A prerequisite for the correct application of the principles of veld control in general and of controlled selective grazing in particular is a knowledge of the order of preference in which stock select plants. Studies with fistulated animals showed that a number of the earlier classifications of plants into palatability categories, which were based on chance observations, were incorrect.

Studies of this type on Karoo veld showed that sheep and goats are more selective with regard to their diet than cattle and that a number of species formally regarded as unpalatable are in fact regularly eaten. There are also considerable

Differences in the order of preference in various seasons.

A trial in which the effect of grazing by sheep and cattle, both separately and together, on the composition and cover of West Coast Strandveld was determined showed that grazing by cattle is the least harmful to the cover and composition of the veld, but grazing by sheep produces the best financial results. This trial is being extended to make provision for various cattle and sheep stocking rates and to determine the effect of Boer goats on the veld.

Supplementary feeding

The effect of supplementary feeding on the grazing habits, voluntary veld intakes and growth of sheep is being investigated in the Free State Region. Protein supplements are placed directly in the rumen through a rumen fistula. The selective grazing habits of the animals are reflected in the sample collected by means of an oesophageal fistula, and an estimate of feed intake is made from the faeces.

The effect of phosphorus supplementation is also receiving attention. Pieces of rib are removed during an operation and analysed for phosphorus and calcium. After the treatments have been applied bone samples can be taken from the same animals again to determine to what extent the natural grazing is able to supply the animal's needs.

Bush encroachment

The research programme on the control of invader bushes by means of aerial spraying is being continued. It is apparent from the experimental work that the best spraying results with Tordon 225 are obtained when spraying is carried out in late summer, when most bushes have a maximum crop of leaves and active translocation to the roots is taking place. Temperatures, humidity, density of the bush, the leaf crop and the soil type are all factors that help to determine the effectiveness of spraying.

Further spraying trials were carried out during the year under review; activators, various spray volumes, night spraying and smaller increments in the levels were tested in order to reduce the cost of effective spraying to the minimum. The aim is to reduce spraying costs in thornveld to about R14,00 per ha.

Research is being undertaken to determine the production potential of the communities in the dry bush/grass communities of the Eastern Cape Region. Apparently these communities can be most efficiently utilised by a combination of grazers and browsers. Preliminary results indicate that meat production can be increased by about 50% by the inclusion of Boer goats in the livestock production system.

Similar trends have been reported in the bushveld areas of South West Africa, which indicates that goats can be very useful in controlling bush encroachment. However, before goats are generally accepted by cattle farmers as an



A heavy infestation of nassella tussock in the Swellendam district

important biological aid, practical solutions to the predator problem will have to be found.

In the Southern Free State chemical and/or mechanical methods of controlling the invader Bekker nestlera *Nesitlera prostrata* are being investigated. Excellent results have been obtained by slashing the veld with a bushslasher and then spraying with Tordon 155. The economics of the various treatments require further investigation, however.

In the Robertson Karoo the inedible, dominant rhenoster bush *Eltropappus rhinocerositis* was effectively killed by burning and bushslashing, but as a result of unsuccessful overseeding with grasses, it recovered to such an extent that the veld reverted to its original condition after 10 years.

Radical veld improvement

Research on the fertilising of natural veld is continuing. It is apparent from trials conducted in the Highveld Region that high yields can be obtained with balanced fertilising without damaging the plant cover. For instance, 7,2 tons of dry plant matter per ha was obtained during the past growing season with a fertilising treatment of 300 kg of N and 15 kg of P per ha, as against 1,6 tons from unfertilised veld.

In the sourish grassveld of the Transvaal Region strategic fertilising of the veld at a low level, applied late in the season, extended the grazing season without any radical change in the veld composition and eliminated the necessity for supplementation.

In trials at Potchefstroom livestock performance was improved considerably by reinforcing the veld with good pasture grasses such as *Digitaria smutsii*, in addition to fertilising. For instance, the mass increase of oxen was 4,5 times greater at a fertilising level of 60 kg of N/ha and 7 times greater at 100 kg of N/ha, in comparison with unimproved veld.

A trial at Bethlehem showed that milk production on fertilised veld can be economic.

In a programme undertaken at Nooitgedacht to identify legumes that are adapted to local conditions, *Vigna vexillata*, *Glycine wightii* and *Lespedeza cuneata* made the best showing. Veld reinforced with *Vigna* and grazed by sheep produced double the yield of the control.

A study on establishment techniques for veld reinforcement showed that *Vigna* and *Lespedeza* can be satisfactorily established with the minimum disturbance of the soil, but that *Glycine* requires preparation of the seedbed.

ARTIFICIAL PASTURES

Eragrostis curvula

The evaluation programme on *Eragrostis curvula* is being continued at Nooitgedacht. Apparently the stage at which grass is cut for hay is critical in determining its palatability, even at high levels of fertilising. Comparative studies with cultivars imported from the USA and the local Ermelo selection have revealed no radical

differences between the selections. The efficient use of *Eragrostis curvula* for grazing depends on management, and considerable progress has been made with the development and refinement of techniques for determining the effect of management on voluntary intake.

Kikuyu

Kikuyu is being evaluated as foggage at Nooitgedacht and Athole. Kikuyu foggage appears to be capable of providing good grazing for both sheep and cattle for the period April to August. Trials are being conducted at present to determine how the value of the grass is affected during September and October by the fertilising level, the stage at which fertiliser is applied and the length of the rest period that proceeds utilisation.

Reports of mortality among stock run on kikuyu as a result of so-called kikuyu poisoning have been received from the Eastern Cape Region.

Cenchrus ciliaris

The evaluation programme on buffalo grass has reached the stage where the research data of the previous four years require to be thoroughly evaluated with a view to further follow-up work.

Results obtained at Tawoomba showed that *Cenchrus*, under continuous grazing, has consistently produced the highest average weaning mass, viz 235 kg. In a trial with 3 fertilising levels and 2 carrying capacities the best economic results were obtained with a live mass increase of 250 kg per ha at a fertilising level of 45 kg of N per ha and a stocking rate of 2 steers per ha.

Digitaria smutsii

The use of *Digitaria smutsii* for both artificial pastures and the reinforcement of the natural veld is receiving increasing attention in research programmes. Preliminary results indicate that this grass retains its palatability to livestock even during winter and at low fertilising levels. Extensive programmes on this promising grass species are planned.

Italian rye grass

Considerable progress has been made with the promotion and commercial distribution of the diploid Italian rye grass cultivar Midmar, which was developed at Cedara. Large quantities of certified seed became commercially available early in 1977. Seed yields of over 1000 kg/ha were obtained in Lydenburg. Interest in this cultivar exceeded all expectations and seed merchants report that their supplies were sold out within a few weeks. Large quantities of basic seed are grown annually from breeders' seed by registered seed producers to ensure that sufficient certified seed will be available each year.

Promising results have been obtained in the breeding programme with the development of a new tetraploid form of Midmar.

Rough cocksfoot

Karkloof, a new rough cocksfoot cultivar developed at Cedara, has been placed on the variety list and is at present undergoing breeders' and basic seed multiplication so that certified seed will soon become available.

This cultivar is also undergoing further evaluation for adaptability together with a number of other rough cocksfoot cultivars at a number of localities in the Republic.

Clover

It was found at the Kokstad Research Station that white clover *Trifolium repens* under irrigation was able to support up to 80 lambs per ha up to the marketing stage, and the meat was graded as "Super". This grazing, which requires no nitrogen fertilising, was responsible for very few goat problems and appeared very promising.

Grass-legume pastures

It is reported from the Karoo that stands of lucerne that have degenerated are being converted to lucerne-grass pastures by overseeding with grasses such as *Phalaris tuberosa*, Kentucky 31 lucerne and rye grass instead of ploughing up the old lucerne stands. These mixtures are used for finishing slaughter lambs and for flushing ewes.

In the summer rainfall areas of the coastal region of the Eastern Cape excellent beef production was obtained during the past four years on grass-legume mixtures based on a tropical legume *Desmodium intortum*. Live mass increases of year-old steers averaged 0,73 kg per animal per day, and 467 kg/ha a year was recorded. At this level of production an annual income of about R93 per ha is possible.

Mediterranean legumes

The evaluation of Mediterranean legumes in the Winter Rainfall Region is continuing. Various medics (annual *Medicago* spp.) and subterranean clovers are being tested at various localities for adaptability and yield.

Preliminary results indicate that medics can be successfully established in the drier parts of the veld and in the Langkloof. Legume yields of three to four metric tons per ha were recorded for most cultivars. Two new cultivars of the species *Medicago truncatula*, namely Jaritz and Ghor, show exceptional promise. Jaritz was impressive with its outstanding dry matter production and strong seedling growth. Ghor is a very early cultivar and is eminently suitable for the drier areas with a short growing season.

Fertilising trials to determine the phosphorus requirements of medics and subterranean clover are in progress at present. Final results are not yet available, but it is evident that there are major differences in the phosphorus requirements of various legumes.

Other crops

The yields obtained from star grass and Coastcross II in the Eastern Cape Region during the past season were as high as the kikuyu yields. There is great interest in these grasses as pasture crops in various areas such as the Natal, Transvaal and Eastern Cape Regions, and their value as cover crops on waterways in lands in the Highveld Region is being investigated. They provided the best cover, but Rhodes grass *Chloris gayana* produced the highest yield. These studies indicate that there are more suitable crops for waterway stabilisation than *Eragrostis curvula*, which is commonly used, and that further research is required here.

FODDER AND FODDER CROPS

Lucerne

Yields of 5 to 8 tons of lucerne per ha, obtained under dryland conditions on the Eastern Highveld, indicate that the value of this crop in these areas was not fully realised in the past. It still appears to be one of the most promising legumes for Highveld conditions and a research programme was undertaken to investigate the crop potential fully. This programme includes the evaluation of the more acid-tolerant types and the determination of the micro-element requirements of the leached soils. There are also indications that the efficiency of various *Rhizobium* races is affected by acid conditions.

It is apparent from trials conducted at Oudtshoorn that the seed production of lucerne increases when the irrigation level is raised from 90 to 135 mm, but decreases when the irrigation level is further raised to 180 mm. No significant differences in seed production were found between the fertilising levels of 0 to 150 kg of K per ha and 20,0, 40,0 and 60,0 kg of P per ha.

Japanese radish

The exceptionally high production potential of this crop in the Eastern Highveld was demonstrated by a planting of the Nooitgedacht cultivar. A January planting during one of the driest seasons on record produced 60 tons of roots and leaves per ha. Even on a dry matter basis (about 6 tons per ha) this compares favourably with yields of 1 to 2 tons of oats or other types of green feed. Even better results were obtained at Kokstad, viz 11 610 kg of dry matter per ha.

Other crops

In comparative studies with various annual fodder crops the following dry matter yields were obtained at Kokstad.

Midmar ryegrass	14 154 kg per ha
Triticale	10 085 kg per ha
Turnips	9 963 kg per ha
Rye	8 798 kg per ha
Wheat	7 887 kg per ha

At Kokstad wheat, oats and rye (foggage) was fed to lambs in pens from July to September. This produced average daily mass increases of over 40 g for wheat and rye, and about 30 g for oats.

At Dundee, on Avalon soils that are very susceptible to waterlogging, it was found that babala can be a very good surrogate for maize, but that forage sorghums do not thrive in such wet conditions. Dry matter yields of up to 16 000 kg per ha were obtained with babala, as against 14 000 kg per ha from maize. The TDN content of babala was only 66% of that of maize, however, and the protein content was also lower.

At Kokstad it appeared that the optimum harvesting stage for maize to be used for silage is about 10 to 12 weeks after silking. The highest yields and best ear filling are obtained at this stage and the silage made is better than that made from maize harvested earlier, when the kernels contain too much moisture.

Saltbush

During the year under review 1 080 kg of seed of old man saltbush *Atriplex nummularia* was made available to farmers by the Karoo Region. Owing to the favourable weather conditions, farmers obtained very good results by directly

overseeding saltbush in veld for the reclamation of bare patches.

The response of old man saltbush under controlled plant feeding conditions was investigated. It was found that sodium is essential for good growth, especially for root development, which also explains why saltbush does better on brackish soils than on soils where there is no brack problem. Potassium requirements appear to be in the region of 150 parts per million, a level which most Karoo soils can supply. Phosphate requirements are higher than was expected and a phosphate content of under 10 parts per million (Olsen method) appears to be a limiting factor.

The new plantings of the Australian saltbush species *Atriplex rhagoides*, *A. portulacoides* var. *appendiculata*, *A. halimus* var. *schweinfurthii* originally produced good summer yields, but are now being damaged by the winter cold to such an extent that early initial summer growth has been weakened.

Atriplex linearis, which was imported from the USA and is closely related to *A. canescens*, is making a good showing and does not appear to be affected by the winter cold.

IV. Utilisation of Agricultural Resources

RESOURCE CLASSIFICATION

The Republic (excluding Transkei) is represented by 70 land type maps (scale 1:250 000), 35 of which are now ready for publication. These maps cover the entire Free State Region (17 maps) and parts of the Winter Rainfall, Karoo, Highveld, Transvaal and Natal Regions. About 80% of the field-work for this survey is now complete.

The field-work for the 1:50 000 soil surveys of the Pretoria-Witwatersrand-Vereeniging (PWV) and the Cape Town-Saldanha-Montagu complexes is now 70% and 35% complete, respectively. Five maps of the PWV area have been published.

Soil surveys were carried out for purposes of irrigation development; detailed surveys were carried out on 1 780 ha and semi-detailed surveys on 901 500 ha.

During the year under review the classification of the soils of 173 000 ha situated in six target areas in the Transvaal Region was completed. 16 000 ha is irrigated soil situated in three target areas and 112 000 ha an extensive cattle grazing area.

In addition 23 investigations into soil potential were carried out with a view to establishing new lands.

Two of the subregions have already been divided into chief farming areas and production standards were determined for the most important crops, both on dry land and under irrigation.

With the Department's primary goal in view, namely the advancement of agricultural development, the Highveld Region chose one area in each staffed extension ward. These areas are representative of the demarcated land types (pedosystems).

At the end of 1973 the Department started using the field staff from the extension group for this task and the classification of the resources in the selected development areas was begun in 1974. Progress is reflected in the table in the next column.

In the course of the Region's development programme 250 000 ha of high-potential soil was comprehensively classified to a scale of 1:20 000. This area consists of 18 areas distributed throughout the Region.

Resource classification maps of seven areas were completed and supplied to farmers in the vicinity. These maps, together with the run-off control planning maps, are used in the comprehensive planning of the farms.

Description	Year under review		
	1975/76	1976/77	Total
Number of development areas identified	4	-	18
Total area of these areas (ha)	32 902	-	244 549
Number of farming units these areas comprise	91	-	510
Area of the areas stereoscopically analysed with the aid of contact aerial photographs (ha) (All variables that affect the soil type, e.g. slope, colour, etc., used as criteria)	24 764	21 838	244 594
Area of the areas checked in the field by means of a drilling programme in respect of soil boundaries, soil types, slope, degree and type of erosion, etc. (ha)	17 470	53 797	244 594
Area of the areas on which profile holes were dug and described on the various soils (ha)	30 752	70 271	244 594
Number of soil samples of the topsoil and subsoil taken in each profile hole and subjected to comprehensive chemical and physical analysis	3 069	5 019	244 594
Area of the areas for which the contact aerial photographs have been finished off and corrections made (ha) (Classification in the field therefore complete)	68 778	71 818	244 594
Aerial land use maps with legends completed to a scale of 1:20 000	4	3	7

Soils are grouped in lands and grazing units grouped together in order to obtain the maximum production without detriment to the resources.

When the resources were classified it was found that compaction of the subsoil occurs on a large scale throughout the entire Region. It was established that about 70% of the high-potential soils of the Vermaas development area (District of Lichtenburg) are already compacted to a greater or lesser extent.

The classification also revealed that about 20% of the soils used for field crop production at present are unsuitable for economic production under dryland conditions. For instance, 25% of the soils in the Clocolan development area (District of Clocolan) are types that should not be used for cash crop production. These soils are not only shallow but also very susceptible to erosion.

The physical analysis of the soils revealed that the topsoils of virtually the entire Region contain a high percentage of fine sand which is extremely susceptible to both water and wind erosion.

Run-off control planning will have to be adapted accordingly. The soil analyses also showed that both the topsoil and the subsoil over a large area have a relatively low phosphate status.

This classification programme enabled the Highveld Region to make further progress with planned agricultural development. Field husbandry guides were compiled in seven development areas. These guides, or proposed adapted systems for branches of farming, are based on the soil and climate situation found in the particular area. The guides cover, *inter alia*, management practices such as the choice of crop and cultivar, plant stand, expected yields and fertilising.

An abridged version of the guide was supplied to 200 farmers in seven development areas together with detailed soil maps, soil analyses and comprehensive run-off control plans. This should enable farmers to make the best possible use of every soil unit on their farms.

If these adapted systems for branches of farming and proposed management practices are followed in these areas, present production can be expected to double.

It became apparent that grain production in the Vermaas development area could be boosted from 8 000 to 14 000 metric tons. In the Argent development area (District of Delmas) a grain yield of 64 000 metric tons, as against the present 19 000 tons, is not impossible.

In order to get the farmers to accept and apply the principles outlined in the guide, nine extension programmes have been launched in the seven development areas.

AGRICULTURAL METEOROLOGY

The Subdivision of Agricultural Meteorology is at present responsible for 30 projects, most of which concern the agroclimate. Agricultural meteorological projects are being rationalised under four key programmes.

The number of agricultural meteorological stations remained fairly constant, although there was some expansion in the summer grain areas, Natal, and the Western and Eastern Cape. The creation of a data system for agricultural meteorology has progressed well and the system should be completed next year. Owing to the goodwill built up over the years, the Subdivision virtually has free access to all Weather Bureau data. During the past year all existing evaporation and rainfall data were obtained from the Weather Bureau and the Department of Water Affairs, encoded and put onto magnetic tape.

A technical communication showing the monthly rainfall probabilities was drawn up in map form. A similar publication indicating the entry and exit dates of certain minimum temperatures for the entire Republic is planned.

Intensive phenological studies on cotton were continued at Loskop, Vaalharts and Upington. A new trial with maize was started at Potchefstroom and is

being extended to about 40 localities in the maize production areas.

Good progress was also made with the design of techniques for predicting ripeness in Ohenimuri and Granny Smith apples in the Koue Bokkeveld and Elgin areas. The Langkloof will also be involved next season. A simple and reliable technique for determining full bloom was developed.

Wind studies were carried out by the sections at Nelspruit and Bien Donné. The wind analysis in the citrus areas has reached the stage where wind data are being collected only at a few strategic points. A good picture of the distribution in these areas has already been obtained. At Bien Donné the evaluation of artificial windbreaks in reducing wind speed has been completed and the results are being prepared for publication.

In the citrus areas it was found that windbreaks at Malelane and Patensie raised the percentage of export fruit from 70% to 95%.

The study of the microclimate at the Theewaterskloof Dam was continued. Five years' data had been collected before the dam was filled. During the winter there were again very strong north-westerly winds.

A minimum temperature study was started at Douglas to determine the influence of topography on the incidence of minimum temperatures and to predict minimum temperatures. This project is closely related to the one in which a mapping technique for interpolating and extrapolating temperatures meaningfully is being investigated.

The project to determine and map the moisture supply potential of rainfall progressed favourably and models were developed for both wheat and maize. Two publications have already appeared. At Cedara the mathematical model for maize yields was modified so that simpler meteorological data can be accepted. A study on radiation absorption in a field of maize was also carried out.

The climatic requirements of green peas are being studies for the last time this season. The evapotranspiration study of pear trees on dwarf rootstocks is in its third season at present and is providing a good indication of how the crop factors increase as the trees grow.

IRRIGATION RESEARCH

Detailed soil moisture determinations in various crops (wheat, citrus and soya-beans) and in a series of soil and climatic conditions, in both experimental and commercial systems, have produced results that are of further interest in irrigation planning and management. Data on wheat yields in relation to measured water consumption, for instance, are valuable in determining water consumption - yield curves.

Another result is that the correct use of tensiometers in the field makes it possible to supplement soil moisture effectively and eliminate both over- and under-irrigation. Measured soil moisture distribution patterns also contribute to a



Erosion on lands is still the major destroyer of South African soil. Shallow ditch erosion on a land in the Southern Cape

better knowledge of the optimum espacement of micro-irrigation drippers or sprays for various soils.

An investigation into the relationship between reduction in wheat yields and salt accumulation in irrigated soil was started.

The direct determination of evapotranspiration by means of three weighing lysimeters in an experimental citrus orchard in the Sunday's River Valley has already produced results that are important in irrigation planning in that area. The lysimeters are being used at present to study the combined effect of salt content and irrigation frequency on the growth and production of citrus orchards.

Weighing lysimeters at Roodeplaat are being used to study water extraction from the soil by annual crops, and loss of moisture in the atmosphere as affected by various soil, plant and atmospheric conditions.

RUN-OFF CONTROL PLANNING

During the year under review run-off control planning in the Highveld Region again progressed very favourably. It involves the mechanical control of floodwaters and surplus run-off in each individual catchment, so that there is no flooding. Works are no longer surveyed on farm units unless the run-off control planning has been finalised.

Planning on an area basis, i.e. the planning of

a catchment that may include a number of smaller catchments, is the first requirement. However, in order not to hamper the construction of essential conservation works on farm units outside such areas, planning is being carried out on the farms on the same basis.

During the period 1971 to 1976 run-off control planning was completed in 38 areas (about 1 155 farm units). During the year under review planning was tackled in four additional areas but has not yet been completed.

The planning of isolated farm units also progressed favourably and 622 farms (as against 621 the previous year) were dealt with. The total number of single farm units planned since 1971 now stands at 2 096. Together with the farm units in the catchments the total is 3 251, constituting 11,9% of the area of the Region.

Essential soil conservation works included in the planning of the above units are shown in the following table.

Contours	-	81 919 km
Waterways	-	8 563 (4 978 km)
Drop inlets	-	630
Overflow structures	-	20
Gabions	-	553

The fact that these data relate to only 11,9% of the area of the Region underlines the serious backlog in the surveying of conservation works. If surveying continues at the present rate, it will take the Region at least 30 years to catch up.

OTHER SOIL AND WATER STUDIES

In addition to soil classification, soil surveys, climatic mapping and the mapping of soil types, the physical, chemical and mineralogical description of soils and the study of water quality and soil - water interactions form an integral part of the resources survey. The co-ordination of soil fertility studies based on soil and climatic properties is also of importance.

Chemical and mineralogical properties

In the course of the chemical analysis programme about 6 000 determinations were carried out on 464 soil samples. These analyses supplement the soil classification programme and are also used to show up problem conditions.

Notwithstanding the lengthy extraction processes, the clay and silt fractions were separated in 88% (900) of all the samples received and the magnesium saturation completed in addition to X-ray diffraction analysis on the silt fractions. Copper, zinc, nickel, chromium, manganese and cobalt analyses were also carried out on the dithionite extract of 800 samples. These data are very valuable in determining what transitional elements, heavy metal elements and micro-elements occur in the solids phase of South African soils, and their degree of availability. Both mineralogical and chemical properties are classified according to soil series standards and the relation between the various properties is established.

Soil physics

During the past year priority was given to the determination of the hydraulic properties of soils and the prediction of soil-water behaviour, and to the physical analysis programme of the resources survey. The installation of the lysimeter at Rooideplaas was completed. The lysimeter is used especially for the building and testing of mathematical models for describing the behaviour of soil moisture.

Mathematical models

Considerable progress was made with the attempted simulation, by means of a mathematical model, of the contribution of drainage water from the irrigated areas next to the Great Fish River to the mineralisation of the river. The chemical characterisation of soil samples required for the model has largely been completed. The grouping of soils into modelling soil units has been completed and the drawing of maps to show their geographical situation started. A trial run with the best soil data and other data available at present was carried out for part of the area and the results combined with those that have been simulated with the hydrological model developed by the Water Research Commission and the CSIR. Realistic salt loads and concentrations in the river were simulated in the trial run.

Soil fertility

Seven regions and five institutes provided fertiliser advisory services for farmers. The number of soil samples involved increased from about 7 000 in 1970 to 11 000 in 1975 and 17 000 in 1976. The numbers of plant samples dealt with in those three years were 600, 16 000 and 10 500. Several publications containing advice on fertilising have appeared.

Good progress has been made with a survey on the soil fertility status of the Republic's soils. The establishment of standards for fertilising recommendations, and the comparison of methods of evaluating available nutrients were promoted by means of several research projects.

Soil compaction on fine sand irrigated soils

Fine sand fractions of 65 per cent and over are characteristic of the irrigated soils of the Southern Cape, where there is a general tendency to compaction. The addition of gypsum and molasses meal as soil ameliorants was investigated, but neither of these could prevent the physical deterioration of the soil. A slight chemical improvement in the salt content was observed, in the upper 30 cm only. The addition of gypsum to the irrigation water improved the moisture infiltration. The most important conclusion was that to prevent extreme soil compaction, soils with high fine sand fractions should not be cultivated if the moisture percentage exceeds 40 on the basis of weight.

The soil science and botanical surveys in the Telemachus/Skulpsspruit catchment in the Eastern Cape were completed. The mapping will be carried out next year. Good progress has been made with run-off control planning, which will be completed early next year.

In the Border Subregion key areas were demarcated for a survey of soil and slope classes on pineapple farms, with a view to designing measures to control the big soil losses that are especially common on pineapple lands.

In the course of an investigation into brack problems and the need for drainage facilities in the irrigated areas of Bucklands and Die Erwe, Douglas, an intensive soil survey was undertaken during the year under review in order to determine the brack status and production potential of the soils in question. 1 123 soil samples were analysed for resources investigations of this type.

SOIL CONSERVATION SOIL CONSERVATION RESEARCH

Research and development on soil conservation is undertaken by a research team at Aliwal North and by several engineers co-operating with members of the regional staff who are involved.

The Soil Conservation Research Team at Aliwal North is working on several registered research projects and a number of pilot projects.

he work is aimed mainly at developing simple and cheap, but effective, measures and structures for the reclamation and conservation of badly eroded and vulnerable areas.

Most of the trial sites are situated in real problem areas, where reclamation and conservation are generally extremely difficult, expensive, and often uneconomic.

The following are noteworthy findings and they need to be emphasised repeatedly:

Common and Spanish reeds are exceptionally resistant to washing away, once established in dongas and water courses.

Propagating Spanish reeds from culms is easier than planting rhizomes, but rhizomes are less vulnerable to drought and other climatic hazards.

All trees in dongas and water courses should be removed. They cause turbulence of flood water and have a depressing effect on grass, reeds and other erosion-resistant vegetation.

Old plant growth on vegetated sediment in dongas has a suppressive effect on vegetation and should be removed regularly - preferably mowed or cut rather than burned or grazed.

The surfaces of sediment deposits on eroded areas become less and less pervious. To ensure a continued good vegetal cover, they should therefore be loosened occasionally with

a tined implement to allow adequate water penetration.

- The gradients of sediment deposits can be significantly increased with the aid of so-called secondary structures. These are inexpensive light temporary structures, judiciously placed and erected on top of the deposited and vegetated sediment, upstream of conservation structures in dongas.
- When sites above soil conservation structures received the necessary care, there was a considerable improvement in the stabilisation and the sediment slopes. This tendency to continual improvement in sediment slopes is so important that it was incorporated in the formula for the prediction curve for sediment slopes.
- Rows of treated pole "jacks" tied together with cables and securely anchored, proved to be an inexpensive way of curbing the very active erosion usually experienced at donga bends. A heavier and more durable "jack", made from 3 m reinforced concrete poles, for use in larger flood streams, has also been designed and is being tested.

Research in the regions

Some of the Division of Agricultural Engineering's staff are co-operating closely with regional staff on conservation research projects.

A well-conserved land with an excellent contour system



The most important are briefly summarised below.

- With the aid of a computer programme, rainfall intensity curves were plotted for 46 weather stations in the Winter Rainfall Region.
- Surveys revealed that, in the light of the latest knowledge of soils, it would be beneficial to modify the contour espacements for certain soil associations in certain areas. These investigations will be extended to other areas in due course. There are indications that it will be possible to determine contour espacements more scientifically in the near future, taking the various soil associations into account.
- Surveys of existing concrete waterways were carried out in contour systems in the Swartland to evaluate their efficiency. The findings are contained in an unpublished report.
- In the Eastern Cape Region a great deal of attention has lately been given to the problem of mechanising cultural practices in newly developed pineapple farms on sloping lands. It appears to be possible to design a semi-parallel contour system which prevents erosion without unduly hampering mechanisation.
- In the Natal Region mechanical tests on soil samples from selected diagnostic horizons have led to the suitability rating of these soils for the construction of impervious earth dams. A report has been compiled.
- A multi-disciplinary international team gathered at Cedara to devise a model to predict soil loss. A publication has been compiled describing the model, its structure, operation and limitations.
- A conservation team from the Natal Region has been allocated the task of refining the model, the aims being to -
collect input data concerning all aspects of soil loss estimation;
compare predicted figures with actual experiments;
hold regular meetings to exchange information;
establish priorities for erosion control research; and
recommend programmes for widespread application of SLEMSA (Soil Loss Estimator for Southern Africa).

In the Highveld Region surveys were carried out on unconventional tillage methods where positive results were obtained with a reduction of wind and water erosion. These methods are being tested in the Summer Grain Centre's programme on cultivation research. Certain planters, which produce promising results in stubble lands and grass-covered lands, will be tested in the course of this programme.

KEY SOIL CONSERVATION WORKS (CONSTRUCTED WITH GOVERNMENT MACHINERY)

Design work in badly eroded or vulnerable soils is undertaken by the Subdivision of Soil Conservation Works at Aliwal North. Key soil conservation works are major works considered necessary for the stabilisation of watercourse soils, together with surrounding areas. Special construction machinery, equipment and manpower, which farmers do not generally have, are required.

Table 1 reflects the progress made with construction work of this kind.

TABLE 1 - Construction of key soil conservation works

Year	New works completed	Value (R)	Number of works repaired	Value (R)
1976/77	19	798 382	17	84 831
1975/76	11	614 599	20	166 882
1974/75	17	463 137	25	217 830
1973/74	8	451 529	15	85 300
1972/73	3	765 759	7	149 317
1971/72	9	401 071	9	115 979

DIRECTIONS TO CONSTRUCT SOIL CONSERVATION WORKS

During the year under review the Division was obliged to issue only one section 4 direction under the Soil Conservation Act of 1969, for the construction of a soil conservation work. This direction concerned an erosion weir in the Eastern Cape Region for which a subsidy of R7 250 was paid. It is anticipated, however, that more directions to construct soil conservation works will be issued in future in order to ensure that essential protective works are built.

RAILWAYS AND ROADWAYS

Owing to incorrect cultural practices in the past the natural flow of water has been altered in some cases and culverts at roadways and railways have been planned according to the changed conditions. Later on, when the water is returned to its natural channel as a result of run-off control planning and correct cultivation, problems may arise with the existing culverts under roadways and railways. In terms of a 1970 Cabinet decision, whichever administration is concerned should make the necessary changes and recover the costs from this Department.

During the year under review claims were received only in respect of one small culvert, a stormwater furrow and a drainage work. Since greater emphasis is being placed on run-off control planning and the construction of contour bank and waterway systems, expenses in this regard are expected to be higher in future.

Soil Conservation Committees

After consultation with Organised Agriculture, soil conservation committees are appointed by the Minister of Agriculture under the Soil Conservation Act to advise the Minister and occupiers of land on soil conservation. The Minister is also empowered to delegate other tasks to the committees. At present there are 251 committees in the Republic and 14 committees in South-West Africa, with 952 and 93 farmer members respectively.

The activities of soil conservation committees differ markedly from one extension ward to the next and it appears that the vigour of individual committees depends largely on the guidance given by officers in the wards and the way the committees are employed on a local level. Some committees are completely inactive, and other committees hold up to 10 or more meetings per year. The Department is investigating the functioning of soil conservation committees at present. The findings are expected to become available within the coming year.

The Soil Protection Advisory Board

In accordance with the Board's wish to meet in a different region each year in order to give members the opportunity to become familiar with the unique problems of the various regions, the Board met in Stellenbosch on 27 October 1976 and the meeting was followed by a one-day tour through the Swartland Subregion of the Winter Rainfall Region.

For the past four years the Board has visited chiefly extensive livestock areas and therefore found the tour to this subregion, where 64% of the area is under cultivation, very interesting.

The Board submitted several recommendations to the Department. The Board was gratified to learn of the research undertaken and other measures applied by the Department to eradicate nassella tussock *Stipa trichotoma* and expressed the hope that the Department will continue with this research and undertake a campaign to make farmers aware of the problem.

FARM PLANNING AND SOIL CONSERVATION WORKS

As can be seen from Table 2, planning has already been carried out for about 73% of the area of the Republic that is capable of being planned. There has been a marked decrease in the number of initial farm plans, but the demand for replanning has increased. The large number of farms replanned may be ascribed chiefly to the fact that, as a result of determined extension work, occupiers of land are now more willing to construct internal camps and stock-watering points than they were a decade ago. The drainage of brackish soil and the construction of contour banks and waterways are also receiving more attention than in the past. As a result of further research and modified farming and

conservation techniques, the demand for replanning will continue, however.

SUBSIDIES

Subsidy rates for soil conservation works, with the exception of hedges and stock-watering pipes, were increased by an average of 38% on 1 June 1976. Notwithstanding these increases, the increase in expenditure on subsidies as reflected in Table 4 was only 14,6% as against expenditure last year. The current economic climate and the heavy rains that fell in many areas during the year under review were evidently the reason for this low figure, especially in respect of the construction of protective works. The construction of grazing utilisation works remained fairly constant, however.

Drainage works for brackish soils and contour bank and waterway systems are receiving more attention, as a direct result of the heavy rains, and this trend will probably accelerate during the next few years. The subsidy rate on protective works will be raised from 55% to 75% in 1977/78, which will have a considerable effect on future expenditure. Although subsidies on grazing utilisation works are to be reduced to 40%, occupiers of land will probably make determined efforts to construct the outstanding works on their farm plans within the coming year, and therefore no decrease in the subsidies on works of this type is expected. However, it is difficult to predict expenditure because all works approved are not necessarily constructed. At present an average of only 40% of all works approved are actually constructed.

As can be seen from Table 5, there was a drop of 6% in expenditure in South-West Africa for the current year, which may be ascribed mainly to the effect of the economic climate. Since subsidy rates for South-West Africa are not being changed, there should not be any notable difference in the expenditure on subsidies during the next year.

GRANTS

(a) Stock Reduction Scheme

The Stock Reduction Scheme, which was introduced on 1 October 1969, is now just about wound up. There are still 112 participants in the Scheme, but their period of participation expires no later than September 1978. Details of participation in the Scheme are given in Table 6 and expenditure on grants is shown in Tables 4 and 5.

Generally speaking, there has been a notable improvement in the condition of the grazing as a result of participation in the Scheme. Another benefit is that facilities such as internal fencing and stock-watering points for rotational grazing have been introduced on all the farms that were involved in the Scheme. The results that have been obtained with the Scheme are both favourable and encouraging. The response and the attitude of the participants towards conservation have changed notably. All things considered the expenditure of R50,5 million on this Scheme, over a period of



This photograph gives an idea of the extent of the driftsand problem on the West Coast

TABLE 2 - Farm planning, 1976/77

Region	New planning	Supplementary planning and replanning	Total % of farms planned
Transvaal	318	301	65
Karoo	323	606	85
Natal	84	286	92
Highveld	294	397	53
Eastern Cape	117	577	82
Free State	302	796	70
Winter Rainfall	112	460	6
Average	221	489	73

TABLE 3 - Farm planning and soil conservation works in South-West Africa

New planning	Supplementary planning and replanning	% of farms already planned
24	457	90

seven years, has been justified.

The Department is at present engaged in a comprehensive evaluation of the Scheme. A report will be completed next year.

(b) Veld Reclamation Scheme

This Scheme has been concluded and grants are no longer paid.

TABLE 4 - Subsidies and grants paid out under the Soil Conservation Act

Financial year	Subsidies on completed soil-conservation works R	Flood-Repair Scheme R	Stock Reduction Scheme* R	Veld Reclamation Scheme* me* R	Grass Land Crop Scheme R
1948/70	20 973 154	103 516	-	2 124 563	287 294
1970/71	2 967 684	599	611 853	553 675	11 842
1971/72	3 023 651	2 219	7 906 502	366 542	13 000
1972/73	2 707 267	10 161	10 713 940	210 468	15 684
1973/74	2 567 339	8 674	9 046 140	43 976	7 688
1974/75	2 976 393	1 132	8 171 637	486	2 824
1975/76	3 591 150	158 680	6 354 693	-	20 000
1976/77	4 115 073	176 555	2 189 075	-	-
Total	42 921 711	461 536	44 993 840	3 299 710	338 544

*Schemes already wound up

STATUTORY CONTROL

From the introduction of the amended Soil Conservation Act in 1969 until 30 June 1977, a total of 9 044 problem cases were dealt with by the Division of Soil Protection. The occupiers of land involved responded well, however, and it was necessary to serve only 446 directions under the Soil Conservation Act, in respect of 187 farms. In 44 cases it was necessary to refer contraventions of the directions to the Attorney General and 27 court cases resulted. Twenty-five of the persons prosecuted were convicted and 2 acquitted.

TABLE 5 - Subsidies and grants paid out under the Soil Conservation Act for South-West Africa

Financial year	Subsidies on completed soil conservation works	Flood Repair Scheme grants	Stock Reduction Scheme grants
	R	R	R
1971/72	1 019 143	-	321 900
1972/73	1 532 137	-	1 057 607
1973/74	1 965 943	-	1 292 931
1974/75	2 017 586	345	1 143 537
1975/76	2 179 683	1 693	1 001 383
1976/77	2 039 156	-	645 821
Total	10 753 648	2 038	5 463 179

TABLE 6 - Participation in the Stock Reduction Scheme

Region	Number of approved participants	Participants who left the Scheme up to 30 June 1977 as a result of -					Number of participants at 30 June 1977
		(a) Changed conditions	(b) Expulsion	(c) Change of ownership	(d) Recovery of veld	(e) Completion of period	
Karoo	3 127	300	20	198	28	2 537	44
Free State	1 595	394	21	157	63	939	21
Eastern Cape	992	134	45	102	46	651	14
Winter Rainfall	419	16	5	24	6	362	6
South-West Africa	439	6	1	44	57	304	27
Total	6 572	850	92	525	200	4 793	112

Tables 7 to 10 reflect the disciplinary action taken against farmers in the various regions of the Republic and South-West Africa by the Division of Soil Protection up to 30 June 1977.

TABLE 7 - Alleged contraventions of the Soil Conservation Act, number of farms on which directions were served and number of directions served, 1969 to 30 June 1977

Period	Number of alleged contraventions	Number of farms on which directions were served	Number of directions served
1969/76	8 647	178	430
1976/77	393	9	16
	9 040	187	446

DISASTER RELIEF

During the year under review the Minister of Agriculture approved flood relief schemes for the following areas: the districts of Albert, Bush River and Calvinia, and the Bechuanaland, Griqualand West, Central OFS and South-Eastern OFS Subregions, the districts of Laingsburg, Sutherland, Beaufort West, Carnarvon, Barkly East and Molteno, the Koonap River Catchment (Post Retief, Winterberge and Macazana, the district of Komga, Stutterheim, Cathcart, Queenstown, Stockenström, Fort Beaufort, Impendle, the Cedarville-Ongeluksnek area, the districts of Karibib, Marico, Thabazimbi, Brits, Bethlehem, Harrismith, Kroonstad and Lichtenburg and the area along the Vaal and Klip Rivers between Villiers and Standerton.

The 11% increase in expenditure on subsidies for the flood relief scheme reflected in Table 4 is

TABLE 8 - Prosecutions under the Soil Conservation Act, 1969 to 30 June 1977

Period	Contraven-tions referred to the A-G	Proceedings instituted	Convictions	Cases pending
1969/1976	39	24	22	
1976/77	5	3	3	5
Total	44	27	25	5

due chiefly to more widespread flood damage than in the past. In many cases works repaired since the

1974 flood relief scheme were damaged again and repairs had again to be subsidised.

TABLE 9 - Number of farms on which alleged contraventions and cases were dealt with during the year under review

Region	Carried over from previous year	New cases during year under re-view	Dealt with during year under re-view	Total pending
Highveld	93	102	50	145
Karoo	331	48	46	233
Natal	259	81	8	332
Eastern Cape	144	26	44	126
Free State	172	35	86	121
Transvaal	245	33	35	243
Winter Rainfall	271	58	63	266
South-West Africa	190	14	29	175
Total	1 705	397	361	1 741

TABLE 10 - Number of farms in respect of which directions were served and dealt with during the year under review

Office	Carried over from previous year	New cases during year under re-view	Dealt with during year under re-view	Total pending
Highveld	16	2	3	15
Karoo	20	0	3	17
Natal	16	1	1	16
Eastern Cape	17	0	0	17
Free State	9	4	0	13
Transvaal	32	0	6	26
Winter Rainfall	18	2	3	17
South-West Africa	0	0	0	0
Total	128	9	16	121

SUBDIVISION OF AGRICULTURAL LAND

Since the Subdivision of Agricultural Land Act came into operation on 2 January 1971 applications in terms of this Act for subdivision, undivided shares, township development and other non-agricultural uses have followed a fixed pattern, showing little variation. One constant characteristic of the applications is the strict advance selection at all levels, so that a very high percentage of applications can be approved.

TABLE 11 - Number of applications dealt with under the Subdivision of Agricultural Land Act, 1971-01-02 to 1977-06-30

11(a) - Applications for subdivision, vesting of undivided shares, township development and incorporation into the areas of jurisdiction of municipal and similar bodies

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1971-01-02/1971-06-30	331	67	153	33	489
1971-07-01/1972-06-30	725	74	252	26	977
1972-07-01/1973-06-30	659	81	157	19	816
1973-07-01/1974-06-30	715	74	253	26	968
1974-07-01/1975-06-30	848	74	294	26	1 142
1975-07-01/1976-06-30	738	76	239	24	977
1976-07-01/1977-06-30	678	77	203	23	881
Total	4 694	75	1 556	25	6 250

11(b) - Applications in respect of leases and servitudes

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1972-07-01/1973-06-30	72	98.6	1	1.4	73
1973-07-01/1974-06-30	92	98	2	2	94
1974-07-01/1975-06-30	68	89	8	11	76
1975-07-01/1976-06-30	49	94	3	6	52
1976-07-01/1977-06-30	60	97	2	3	62
Total	341	95	16	5	357

The pattern of approved and rejected applications shown in Table 11(a) is a fairly constant one, namely 75% approvals and 25% rejections. The pattern in respect of approved and rejected leases and servitudes has also remained fairly constant.

TABLE 12 - Subdivision for agricultural purposes

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1971-01-02/1971-06-30	246	73	92	27	338
1971-07-01/1972-06-30	617	86	101	14	718
1972-07-01/1973-06-30	494	83	99	17	593
1973-07-01/1974-06-30	611	85	105	15	716
1974-07-01/1975-06-30	665	80	166	20	831
1975-07-01/1976-06-30	576	77	170	23	746
1976-07-01/1977-06-30	598	85	107	15	705
Total	3 807	82	840	18	4 647

Of the 881 applications received during the past year (shown in Table 11(a)), 705, i.e. 80%, were solely for agricultural purposes. Of these 705 applications, 107 (15%) were rejected, which is very close to the average for the whole period.

The percentage of rejections might be expected to drop as farmers begin to realise what kind of application has a chance of succeeding. The fact that the ratio remains constant is an indication firstly of a degree of optimism among the applicants but also of the fact that it is no simple matter to determine what a minimum unit is. Despite the economic climate the number of applications remains more or less constant.

TABLE 13 - Number of farming units created and number of farms and area of farms consolidated with other land, 1972-01-02 to 1977-06-30

Period	New farming units created	Consolidation	
		Number of farming units	Area (ha)
1971-01-02/1971-06-30	233	116	48 951
1971-07-01/1972-06-30	152	436	103 799
1972-07-01/1973-06-30	134	342	88 178
1973-07-01/1974-06-30	116	503	164 353
1974-07-01/1975-06-30	153	523	174 203
1975-07-01/1976-06-30	61	385	173 122
1976-07-01/1977-06-30	107	316	217 321
Total	955	2 621	974 932

Permission for the creation of new units and for the vesting of agricultural land in the names of more owners has necessarily resulted in an increase in the number of owners and farms. Statistics nevertheless show that, owing to the consolidation of properties and other conditions, the number of owners and farms has decreased by 209 over the past year. 316 farming units that do not comply with the minimum requirements for farm size disappeared in the process. This brings the total since 2 January 1971 to 2 621, and the area to 974 932 ha. On the other hand only 107 new units have been established. The number of new farming units for the entire period from the beginning of 1971 to 30 June 1977, is 955.

The position is therefore that a large percentage of the applications submitted merely involve the conversion of existing properties into new units and often result in a reduction in the number of units.

Subdivision of Agricultural land for non-agricultural purposes

The number of applications for subdivision for non-agricultural purposes dropped considerably over the past year. A large number of the applications rejected were for extensive occupation.

The applications for subdivision for non-agricultural purposes are divided into two groups in Table 14, viz:

- Extensive occupation, commercial purposes, resorts and mining,
- Intensive urban use

Notwithstanding the fact that the number of approvals for extensive occupation, commercial purposes, resorts and mining dropped from 75 to 14 the area was slightly higher than last year. The reason is that mining operations have expanded

TABLE 14 - Subdivision for non-agricultural purposes - number of applications and area involved

Period	(i) Extensive occupation, commercial, etc.						(ii) Intensive urban use					
	Approved			Rejected			Approved			Rejected		
	Number	%	ha	Number	%	ha	Number	%	ha	Number	%	ha
71-01-02/71-06-30	74	54	2 612	65	46	7 244	11	92	1 426	1	8	66
71-07-01/72-06-30	129	56	2 825	100	44	8 259	29	97	1 152	1	3	13
72-07-01/73-06-30	91	63	3 879	53	37	3 998	74	94	10 763	5	6	1 338
73-07-01/74-06-30	105	50	3 361	103	50	6 975	90	98	8 133	2	2	432
74-07-01/75-06-30	86	43	3 706	113	57	5 700	97	95	13 751	15	5	3 296
75-07-01/76-06-30	75	54	2 248	63	46	2 704	75	90	16 576	8	10	868
76-07-01/77-06-30	14	13	2 396	92	87	5 973	66	94	44 292	4	6	70
Total	499	46	21 047	589	54	40 853	442		86 093	36		6 083

considerably recently. No less than 713 ha had to be relinquished for mining. Other large areas that had to be relinquished included 275 ha for an airfield at Kroonstad, 127 ha for a brickyard and 117 ha for a sewerage plant.

The large number of rejections, viz 92 (87%) out of the total number of applications for extensive occupation, commercial purposes, resorts and mining is a result of the fact that a large number of applications to cut off small pieces of agricultural land for commercial purposes are received each year. In these cases this Department is supported by the Department of Planning and the Environment and the provincial authorities concerned.

During the year under review permission was granted for 44 292 ha to be relinquished for intensive urban use. The reason why this area is so large is that 28 008 ha in South-West Africa had to be relinquished for two peri-urban areas. In addition 7 400 ha at Germiston and Mitchell's Plain was relinquished for housing for Bantu, Indians and Coloureds. If this 35 408 ha is subtracted from the figure of 44 292 ha, 8 884 ha remains - considerably less than the previous four years' average of 12 305 ha, which is in accordance with the general trend towards a slight drop in the use of agricultural land for non-agricultural purposes.

WEED CONTROL

RESEARCH

A research program was launched recently to study the physiology of jointed cactus, *Opuntia aurantiaca*. It is hoped that this research will provide better understanding of the plant and its reaction to weedicides so that control measures can be improved if possible. Initial results have already thrown more light on the factors that affect the uptake of weedicides and strengthened the hope that more effective control measures will soon be found.

An urgent research project was aimed at the evaluation of methods for the destruction of a new cactus weed, *Opuntia rosea*, which is spreading rapidly in the Douglas district. A water-soluble weedicide, 2,4,5-TP, can effectively control this weed and will be used in a large-scale spraying campaign.

Nasella tussock grass remains a serious threat to veld and cultivated pastures in the damp, high-lying areas of the Eastern Cape. Trials with

weedicides showed that proprop, glyphosate and bromacil can effectively control the plant. The application of proprop, which has a short after-effect and glyphosate which is not permanent, must be followed up with a spraying of the seedlings.

Bromacil, which sterilises the soil and has so far prevented reinfestation for 2 years, is preferred where a follow-up treatment will be difficult to apply, although initial high costs and the danger of soil erosion on treated areas are disadvantages of this method.

Eastern Cape Region

JOINTED CACTUS

The State has already spent over R8,5 million on spray for controlling jointed cactus. Good progress was made, but it is very difficult to eradicate jointed cactus completely. The major problem is that follow-up operations are inadequate.

At present there are 1 707 applicants in the inspection area who have applied for free spray or to participate in the control programme. This is an increase of 548 applicants, or 47% since 1964.

The total area of the farms in the inspection area that are infested with jointed cactus increased from 1 212 157 ha during the first evaluation analysis in June 1964 to 1 645 569 ha in June 1977.

This means that the inspection area has expanded by 433 412 ha over the whole period, and by 1 543 ha during the year under review - increases of 35,8% and 0,13%, respectively.

During the first evaluation analysis in June 1964, 643 719 ha in the inspection area was classified as infested. This area expanded by 184 876 ha (28,7%) and at present comprises 828 595 ha.

In the course of the exploratory inspections it was found that 394 196 ha (61%) of the veld that had really been infested had been brought under control. By June 1977 662 417 ha (80%) of the 828 595 ha that had really been infested was under control.

The situation and progress in respect of jointed cactus control in the Eastern Cape and Karoo Regions are shown separately in Tables 15 and 16.

Government teams controlled jointed cactus on 27 uneconomic units; only very small contributions were received from the owners.

Conditions on these farms are deteriorating rapidly as a result of labour, physical and financial problems.

The cost of spray is the major cost item in the control of jointed cactus.

Total quantities of spray issued at the spray depot at Fort Beaufort are shown in Table 17; the figures include spray issued outside the inspection areas. The consumption of spray dropped slightly over the past year.

Spraying trials are being carried out on *Opuntia Rosea* infestations in the Eastern Cape



TABLE 15 - Jointed cactus infestation in the Eastern Cape Region and the efficacy of control: 30 June 1964 to 30 June 1977

Year	Number of owners/ occupiers	Size of properties (ha)	Infested veld (ha)	Veld not infested (ha)	Lands not infested (ha)	Infested veld under control (ha)	Efficient	Control (owners)	
								Fairly effi- cient	Inefficien-
June 1964	957	788 444	471 049 60%	291 076 37%	26 319 3%	55%	259 800 40%	385 270 28%	302 32%
June 1968	1 271	969 419	569 248 59%	365 468 38%	34 703 3%	428 104 75%	890 70%	272 21%	109 9%
June 1972	1 364	1 057 679	598 548 57%	424 370 40%	34 761 3%	458 530 77%	954 70%	277 20%	133 10%
June 1976	1 416	1 083 125	603 883 56%	441 232 41%	38 010 3%	459 088 76%	1 019 72%	232 16%	165 12%
June 1977	1 424	1 074 080	602 865 56%	433 176 40%	38 039 4%	466 208 77%	1 046 73%	228 16%	150 11%

TABLE 16 - Jointed cactus infestation in the Karoo Region and the efficacy of control: 30 June 1964 to 30 June 1977

Year	Number of owners/occupiers	Size of properties (ha)	Infested veld (ha)	Veld not infested (ha)	Lands not infested (ha)	Infested veld under control (ha)	Efficient	Control (owners)	
								Fairly efficient	Inefficient
June 1964	202	423 714	172 670 41%	244 671 58%	6 373 1%	78%	134 396 62%	126 60 30%	16 8%
June 1968	240	462 878	188 402 41%	264 281 57%	10 195 2%	158 651 84%	170 71%	65 27%	5 2%
June 1972	276	545 594	210 212 39%	326 933 60%	8 449 1%	162 503 77%	219 79%	42 15%	15 6%
June 1976	285	560 901	221 181 40%	331 329 59%	8 391 1%	191 718 87%	213 75%	42 15%	29 10%
June 1977	283	571 489	225 730 39%	336 930 59%	8 829 2%	196 209 87%	178 63%	58 20%	47 17%

TABLE 17 - Quantities of spray issued at the spray depot at Fort Beaufort 1957 to 1977 (litres)

Year	Jointed cactus	Imbricate cactus	Prickly pear	Total
1957/1961	12 952 858	-	± 845 718	13 798 576
1961/1965	21 058 560	-	2 166 996	23 225 556
1965/1969	30 444 733	82 482	1 403 725	31 930 940
1969/1973	22 453 705	120 033	381 511	22 955 249
1973/1976	12 663 600	54 200	224 200	12 942 000
1976/1977	3 766 800	11 000	92 400	3 870 200
Total	103 340 256	267 715	5 114 550	108 722 521

HAKEA

Good progress was made with the control of hakea in the Port Elizabeth district and this weed is under control at present.

The control programme in the Humansdorp district is continuing. Ninety-four farmers/bodies are engaged in controlling hakea in this area.

Hakea occurs on about 33 906 ha, 28 978 (85%) of which is classified as being under control.

Karoo Region

It was found that, generally speaking, weeds have increased enormously in this Region and farmers are showing little interest in applying control measures.

JOINTED CACTUS

Despite the fact that only 473 properties were visited during the year under review (as against 914 the previous year), a number of persons who had done nothing about controlling jointed cactus previously made a positive start. This is largely the result of repeated visits to those persons. Generally speaking, however, the position deteriorated. There is some doubt about the effectiveness of the spray when it is applied during hot, dry periods.

No new infested farms were reported. The number of farms infested was 286, and the total area 559 158 ha. However, the area infested increased from 221 204 to 232 069 ha.

Insufficient labour is still hampering effective control. The density of other vegetation in infested areas is also causing problems.

SCALY CACTUS

Control of scaly cactus is satisfactory on the whole. However, some farmers are inclined to overlook isolated plants as unimportant. These plants multiply and the result is a big infestation.

Spraying is not always followed up in order to destroy regrowth. The plants are not destroyed by a single spraying. Another problem is that rock gardens remain a source of infestation.

PRICKLY PEAR

Control is undertaken in most cases, but the available spray is not always effective.

SILVERLEAF BITTER APPLE (SATANSBOS)

Infested properties are still being discovered. Little or nothing is being done about the big infestation at Kendrew. It was not possible to take action against these farmers since no registered weedkiller for controlling silverleaf bitter apple is available.

SPINY COCKLEBUR AND RELATED SPECIES

Owing to the floods the infested areas are very much larger than previously and control of these weeds is extremely poor. During the past year 14 notices were served, but not a single farmer responded.

SCOTCH THISTLE

Whereas isolated plants used to be found, this weed is now taking in vast tracts of the vleis. Control is poor.

NASSELLA TUSSOCK (*STIPA TRICHOTOMA*)

More and more infestations are being discovered. On farms, where it is still rare, serious efforts are being made to control the weed, even with the aid of weedkillers.

It is virtually certain that most of the farms situated among the infested farms are also infested, but nothing is being done. Farmers do not appear to be aware of the dangers and show little interest in finding out what the grass looks like so that they can determine whether it is present on their farms or not.

In the Karoo Midlands Subregion a course of action which involves a combined and organised campaign by farmers to eradicate the weed has been decided on. Where the dangers are realised good co-operation is obtained.

A farmer's day was held at Graaff-Reinet and nassella was shown to farmers and labourers in the veld. The day was a success and the turn-out was good, but a similar farmer's day at Cradock was poorly attended.

Research

Although *Prosopis* is fairly generally planted as a fodder tree in the low-rainfall areas of the Karoo Region and played an important part as supplementary fodder during droughts, it is now unfortunately necessary to take steps to control its rapid spread. In some parts *Prosopis* is already regarded as a serious invader plant, especially since it grows chiefly in the high-potential areas such as hollows and waterways in these low-rainfall areas.

A survey was carried out with the aid of questionnaires to determine the exact extent and degree of encroachment. The magisterial districts where encroachment is most serious are Carnarvon, Hay and Kenhardt.

Since the dreaded nassella tussock also occurs in the Karoo Region, control is receiving top priority. A survey showed that about 3 000 ha is infested with nassella tussock in varying degrees.

The most serious infestation in the Karoo Region, which is also generally accepted as the densest infestation in the Republic, occurs at Boschberg in the Somerset East district. A few farms in the neighbouring districts such as Pearston and Graaff-Reinet are also infested with this weed.

A project for testing methods and weedkillers for the successful eradication of nasella tussock has been designed.

Free State Region

The heavy jointed cactus infestation on mined areas at Jagersfontein where no grazing is permitted would have been difficult to spray because of the dense stand of grass. This tract of veld was burnt and the jointed cactus so severely burnt that it was only in isolated cases that it was necessary to spray regrowth.

On a property at Barkly West 80% of a heavy infestation of jointed cactus was wiped out by cochenille.

IMBRICATE CACTUS

Very good results were obtained with the eradication of imbricate species by means of spraying and mechanical methods. However, owners do not carry out re-inspections and regrowth of the weed is common.

Complaints were received that Tordon was not producing the desired results, but it was found on investigation that the plants had not been thoroughly sprayed to the dripping wet stage and insufficient time had been allowed for the plants to die. If a little 2, 4, 5-T is added to Tordon, the problem is easily solved.

Biological control produced outstanding results in the Douglas, Barkly West and Longlands districts.

ORGAN PIPE CACTUS

This weed has multiplied tremendously and if it is not proclaimed it could become a serious problem.

In the Free State Region the position is under control with regard to *Opuntia* species, except *Opuntia rosea*, which occurs on three farms in the Douglas district.

SILVERLEAF BITTER APPLE (SATANSBOS)

Infestations of this weed are still found near Edenburg, Springfontein and Kaffir River. Because no effective spray is available, the weed is still multiplying.

INSPECTIONS

The Free State Region still has only one weeds inspector, stationed in the South-Western Free State Subregion. Following instructions, he gives preference to the inspection of jointed cactus, *rosea* and imbricate cactus, which are widespread in the Southern Free State and Griqualand West.

Particulars of weeds inspections are given in the accompanying table.

Weeds inspections carried out

Type of weed	Number and type of inspections		
	No weeds	First inspection	Reinspection
Jointed cactus		7	13
Imbricate cactus		69	74
General weeds		87	10
Silverleaf bitter apple		2	-
No weeds found	72		
Total number of inspections	334		

SUIDWES-AFRIKA SOUTH WEST AFRICA

- 
 Hoofkantoor en Substreekkantoor/
Head Office and Subregional Office
- 
 Landboukollege/
College of Agriculture
- 
 Navorsingsstasie/
Experimental Station
- 
 Voorligtingskantoor/
Extension Office
- 
 Substreekkantoor/
Subregional Office



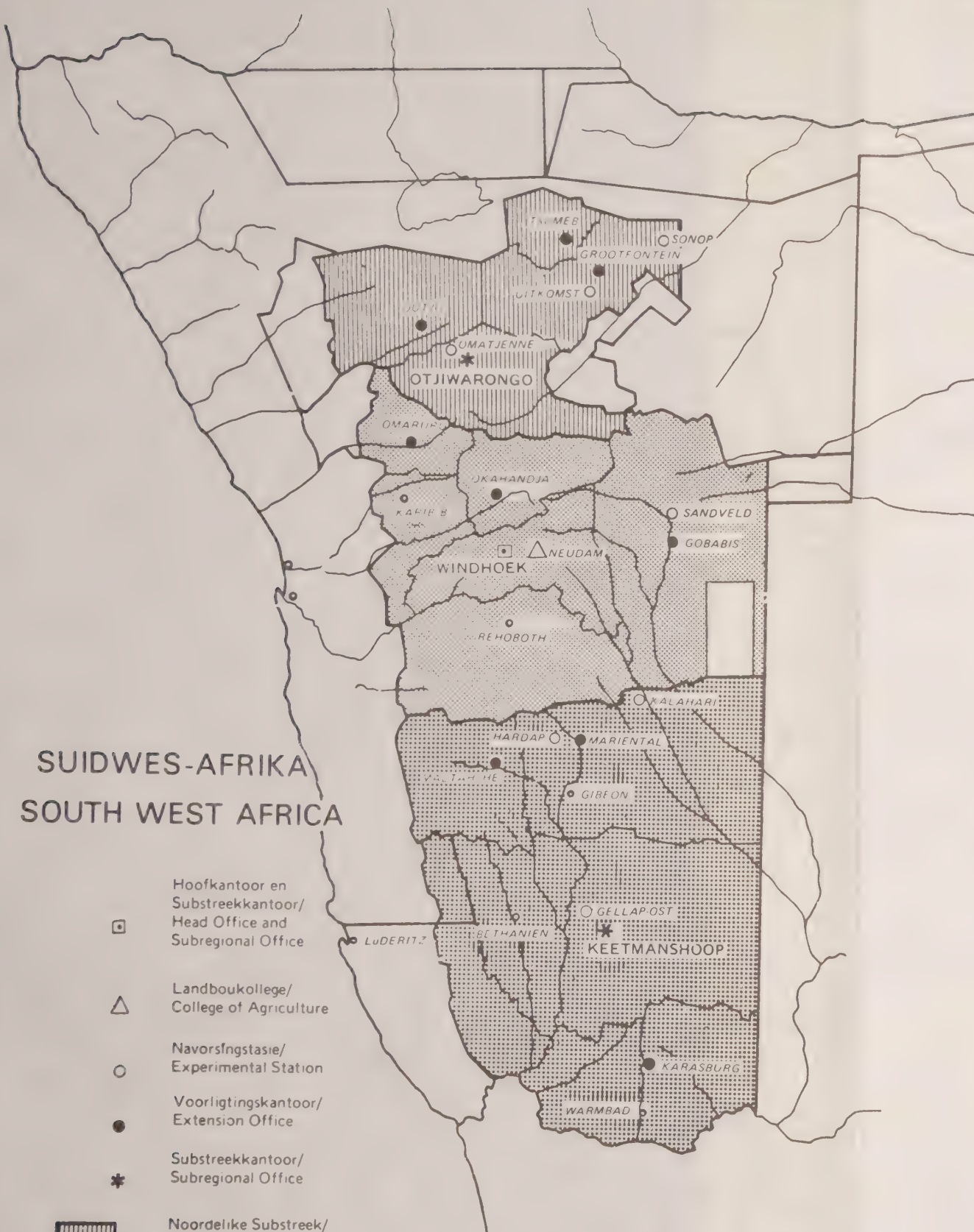
Noordelike Substreek/
Northern Subregion



Sentrale Substreek/
Central Subregion



Suidelike Substreek/
Southern Subregion



V. Entrepreneur Development

AGRICULTURAL EXTENSION SERVICES

The regional organisations of the Department are responsible for the development of the entrepreneur in the agricultural industry.

This responsibility rests chiefly with the extension staff of the regions and is fulfilled by meeting a variety of challenges - which may vary from year to year - in the field of agricultural extension. We shall therefore refer briefly to certain new trends that emerged during the year under review.

NEW TRENDS AND PROBLEMS

HIGHVELD REGION

(i) Lichtenburg Subregion

- (a) Larger plantings of sunflowers.
- (b) Greater use of chemical weedkillers.

(ii) Heidelberg Subregion

- (a) Increase in the use of big tractors.
- (b) Larger plantings of grain sorghum and sunflowers at the expense of maize.

(iii) Harrismith Subregion

- (a) Sheep numbers are showing an upward trend.
- (b) Grain sorghum and sunflower production - particularly the latter - are attracting increasing interest.
- (c) Establishment of perennial pasture crops on lower-potential soils.

(iv) Kroonstad Subregion

- (a) Larger plantings.
- (b) Increase in fat lamb production.
- (c) Stabilisation of weaner calf production at the expense of woolled sheep production.
- (d) Better provision for the winter feeding of dairy cattle.

(v) Bethlehem Subregion

- (a) Far more sunflowers and more grain sorghum but less maize planted.
- (b) A very lively interest in soil conservation was evident, especially in the Senekal ward.
- (c) Farmers are showing increasing awareness of the value of optimum resource utilisation.

(vi) Potchefstroom Subregion

- (a) An exceptional number of farmers are switching from maize to sunflowers.
- (b) With the abundant rains farmers withdrew low-potential soils from cultivation.
- (c) Great interest in artificial pastures.

(vii) Bothaville Subregion

- (a) Greater use made of sunflowers.
- (b) Switch to larger implements.

The following matters will receive more attention in the near future:

(i) Lichtenburg Subregion

- (a) The fertilising of maize according to soil potential.
- (b) Grazing management and veld fires.

(ii) Heidelberg Subregion

- (a) The surveying and construction of soil conservation works, especially waterways.
- (b) The promotion of optimum farming practices by means of courses and newsletters, in accordance with results in development areas.
- (c) The encouragement of correct stock feeding methods by means of a subregional newsletter.

(iii) Bethlehem Subregion

- (a) Trace-element fertilising of summer cereals.
- (b) Lodging in maize.
- (c) Roots diseases of wheat.

(iv) Bothaville Subregion

Hydrological planning of catchments.

KAROO REGION

New trends

- (a) In the *North-Eastern Karoo Subregion*, especially in the Colesberg extension ward, an observation of the past few years, namely that there has been noticeable hybridisation among the Merino population, was confirmed. This trend is becoming firmly established in the Karoo Region.
- (b) In the *North-Eastern Karoo Subregion*, especially in the De Aar extension ward, injudicious speculative cattle farming is taking place on veld that is unable to support cattle



Instruction in artificial insemination being given during a course at the Elsenburg College of Agriculture

on a permanent basis. Feeding problems arise during the winter months, with consequent financial losses and damage to valuable grassveld. This tendency is also evident in the other higher rainfall areas of the Karoo Region.

- (c) In the *Karoo Midlands Subregion*, especially in the Jansenville, Somerset East and Cradock

extension wards, farmers are enlarging their flocks of Angora goats considerably. Angora goats are now found in places where they were never previously run.

- (d) In the *Karoo Midlands Subregion*, especially in the Cradock and Somerset East extension wards along the Great Fish River, farmers are tending to grow more and more vegetables



Guests are shown grain cultivars and informed of new practices during a visitors' day at a Departmental research station

under contract to factories. Sweetcorn is especially popular.

- (e) Livestock numbers are increasing throughout the Karoo Region. Participants in the Stock Reduction Scheme who have already left the scheme are showing a strong tendency to increase their livestock numbers.

NATAL REGION

Chief trends

- (a) Cotton plantings increased, especially in the Mkuze and Hluhluwe areas. About 2 000 ha of new cotton lands were planted during the year under review.
- (b) Many old sisal plantations are being ploughed up at present. About 3 000 ha of sisal plantations near Mkuze have been ploughed up and large areas are being planted with cotton.
- (c) Owing to economic pressure interest in the production of high-risk but highly profitable crops such as potatoes, cabbage, tomatoes and other vegetables has increased. Producers are looking for more economically stable crops that can be grown under irrigation, especially in the irrigated areas of the Natal Midlands and Northern Natal. In the vicinity of Ixopo, Pinetown, Port Shepstone and Pongola bigger and bigger areas are being planted to vegetables.
- (d) Owing to increasing economic pressure, greater use has been made in the Natal Region of the cheaper soil analysis service of the Department over the past few years. The analysis of soil samples at Cedara increased by 46% last year.
- (e) For economic reasons interest in the production of subtropical fruit to replace sugar-cane has increased in Zululand.
- (f) Preference is being given to natural grazing rather than purchased or home-grown feed for beef production. This was accompanied by greater interest in artificial pastures in the Newcastle and Melmoth areas. Fat lamb production on artificial pastures is becoming increasingly popular.
- (g) In Northern Natal there is a growing interest in maize production. Both horizontal and vertical expansion is taking place at present, accompanied by greater mechanisation and improved fertilising practices.
- (h) Throughout the entire Natal Region there has been increasing interest in the founding of organisations to control veld and forest fires. Excellent progress has already been made and the existing bodies are very well organised and equipped.
- (i) Citrus plantings in the Nkweleni valley have been expanded.
- (j) Bush encroachment on game farms in the sweetveld areas of Natal is becoming a serious problem.
- (k) Game farming in the bushveld areas of Pongola is increasing in popularity.

- (l) There has been a major increase in the cultivation of vegetables on steep slopes, especially in the Coastal Subregion of Natal.

FREE STATE REGION

The problems and trends of this Region are as follows:

(i) Gordonia Subregion

- (a) Correct supplementation during the winter months remains a problem for sheep farmers.
- (b) Brack problems owing to poor irrigation planning in the laying-out of irrigated soils.
- (c) The after-care of large areas of burnt grazing.
- (d) The practice among Karakul farmers of providing small camps for wet ewes.
- (e) There has been an increase in the cattle population.
- (f) The introduction of first-crossing karakul ewes to boost livestock numbers after the Stock Reduction Scheme.

(ii) South-Eastern Free State Subregion

- (a) Larger sunflower plantings at the expense of maize.
- (b) Elimination of cash crops at the expense of dryland lucerne.

(iii) Griqualand West Subregion

Tobacco plantings are still expanding.

(iv) Central Free State Subregion

- (a) Larger plantings of sunflowers, up to 300% more in parts.
- (b) Increase in beef cattle numbers.
- (c) Expansion of dryland potato cultivation.

(v) South-Western Free State Subregion

- (a) Cattle numbers rose, which could lead to overgrazing.
- (b) Luxuriant growth of the grass and over-rigid recommendations on camp systems led farmers to rely on their own judgement, which resulted in trampling of the veld.
- (c) Provision of dumping sites for irrigated plots at the Riet River which are experiencing brack problems.
- (d) A general tendency to establish larger lands in order to produce more feed as a solution to the rising feed costs.
- (e) A switch from dairy farming to beef farming at Edenburg.
- (f) Woolled sheep are being replaced by mutton sheep, especially in the western parts of the subregion.
- (g) Increasing quantities of sandveld are being ploughed for winter grain production.
- (h) Sheep farmers are including more cattle in their enterprises because grazing has become "too overgrown for sheep".
- (i) An increase in sunflower production.

EASTERN CAPE REGION

General trends:

- (a) A switch from sheep to cattle.
 - (b) Angora goat farming is receiving more attention.
 - (c) A change-over from dairy to beef farming.
- In future the extension campaign will be geared to the following problems:
- (a) The control of undesirable plant encroachment.
 - (b) The over-wintering of livestock, especially in sourveld areas.
 - (c) Soil losses on pineapple lands.
 - (d) The construction of effective contours on lands.
 - (e) Efficient veld control, which goes hand in hand with the improvement of the veld.

WINTER RAINFALL REGION

New trends:

- (a) The inclusion of livestock through the promotion of artificial pastures.
- (b) The stimulation of milk production.
- (c) An increasing use of tunnels for vegetable cultivation.
- (d) The establishment of vineyards under plastic.
- (e) The expansion of rooibos tea production.

More attention will be given to the following problems in future:

- (a) Motivation of producers to control downy mildew, gerbilles and noxious weeds.
- (b) Irrigation planning and scheduling for permanent crops.
- (c) The determination of the irrigation potential of the Breede River Valley.
- (d) More detailed soil classification for purposes of farm planning in the intensive farming areas.
- (e) Artificial pastures for the Swartland.
- (f) Re-establishment of old lands in the north-west.

TRANSVAAL REGION

New trends:

- (a) Greater interest in the tunnel cultivation of vegetables on small units.
- (b) Greater interest in kikuyu plantings for sheep on small units.
- (c) Higher cotton prices may lead to increased plantings on irrigation schemes, at the expense of wheat.
- (d) Sunflower plantings are increasing at the expense of maize.
- (e) A sharp decrease in the fattening of cattle.
- (f) The bigger farmers are specialising in tobacco cultivation and the smaller farmers switching to wheat and soya-beans.
- (g) The cultivation of dryland wheat is increasing, both on the Springbok Flats and in the Dwaalboom area.
- (h) The marketing of game in the sweet bushveld is increasing.

- (i) There is a discernible decrease in the application of large amounts of nitrogen to artificial *Eragrostis* pastures.
- (j) Air-cured tobacco is being planted on a large scale in the Eastern Transvaal Subregion.
- (k) Seed beans are becoming increasingly popular as a cash crop.

The following problems will require more attention from the extension service in the immediate future:

- (a) Further research on rootrot in avocados.
- (b) Research on weeds in the Lowveld.
- (c) More research on legumes for veld improvement.
- (d) Co-ordinated co-operation with private bodies.
- (e) Research on the fertilising and cultivation of Waterberg sandy soils for economic cash-crop production.
- (f) Drainage of soils below irrigation schemes at Loskop and Brits.
- (g) Investigation into the part played by maize, especially maize plant residues, in overwintering livestock.
- (h) The economics of meat production from artificial pastures on small units.
- (i) The reclamation and utilisation of opencast mining soils.

PROGRESS WITH PROGRAMME PLANNING

EASTERN CAPE REGION

(a) Communication Programmes

Programme planning, which has long been accepted as a method of work, came into its own with the registration of six key programmes and 40 liaison projects since 1972/74 and the appointment of responsible officers to carry them out. Extension in the Eastern Cape Region has been given a new dimension, because progress can now be evaluated scientifically for the first time and the responsible officers given recognition for the job they are doing.

Programme planning is not confined to extension officers; extension technicians are also made responsible for matters that fall within the scope of their duties.

So far 10 liaison projects have been concluded and final reports compiled, and the data from three have already been published in *Agricultural Research*. About 10 liaison projects will be completed in 1977/78.

These liaison projects cover a wide field and include key programmes on:

- Veld improvement and protection;
- protection of cultivated soil against erosion;
- community development;
- promotion of red meat production;
- catchment planning; and
- small stock management.

Liaison project OK-VL 13/1, which has already been in progress for 11 years, is a good

example of a successful extension project. The purpose was to reduce the large stock:small stock ratio to about 1:8 and try to keep it there. Because the ratio tends to be sensitive to any change in wool and meat prices, the project was continued for a few years after the aim had been achieved, in order to determine how stable the change and the maintenance of the goal really were.

The primary methods employed by the extension service are those of mass media and group communication. For instance, an extension project dealing with the control of *Nasella tussock* *Stipa trichotoma* and *Stipa tenuissima* in the Barkley East extension ward reached all parts of the country when the introductory phase of the working programme started.

(b) Contour programmes

No new programmes were registered during the year under review. It was possible to achieve the goals for the year in only one of the 11 programmes, viz that for Humansdorp. This comparative lack of progress may be ascribed to the following factors:

- The lack of suitable waterways, which hampers the surveying of contours.
- The high percentage of farmers who are still unwilling to apply contour cultivation on their lands.
- The steadily increasing fuel prices, which hamper progress.

The increase in subsidy rates may improve the progress made with these programmes.

The following table shows the progress made during the past two years:

Progress with contour programme at Humansdorp

	1975/76		1976/77	
Mass extension				
Number of demonstrations and farmers' days	13		29	
Number of persons present	26		78	
Number of meetings at which matter was raised	85		80	
Number of newsletters	16		15	
Number of radio reports and press releases	14		15	
Area of lands involved	Ha	%	Ha	%
Dry lands in Region	341 154	100	342 502	100
Dry lands that do not require protection	83 335	24,4	869 27	25,4
Lands already protected by mechanical means	171 838	50,4	172 833	50,4
Mechanically protected during year under review	2 910	0,9	2 801	0,8
Withdrawn from cultivation during year under review	1 787	0,5	1 209	0,3
Established under ley crop	4 653	1,4	8 236	2,4
Lands that still require protection	76 631	22,5	70 496	20,6
Pegging out of contours and individual extension				
Number of waterways pegged out	32		64	
Length of contours pegged out (km)	597		644	
Number of officers concerned	36		32	
Number of man days spent	230		266	
Persons cautioned under the Soil Conservation Act				
Directions issued	0		0	
Persons cautioned verbally or in writing	122		96	

KAROO REGION

Programme planning forms the basis of all extension activities in the Karoo Region. Thirteen extension programmes were in operation during the year under review. The results of the most important will be indicated briefly.

An extension programme for the Great Fish River Valley

The purpose of the programme is to improve farmers' knowledge of irrigation farming to such an extent through mass, group and personal extension activities that production will increase considerably in the foreseeable future.

The programme is being carried out in the soil conservation areas of Cradock and Somerset East.

During the year under review the following activities - all related to the programme - were arranged:

	Number	Attendance
• Farmers' days	2	114
• One-hour meetings	10	230
• Other meetings	3	141
Total	15	485

Pamphlets and other publications were distributed on each occasion.

The subjects dealt with include the following:

- Planning for the mechanisation of a milking parlour
- A forage crop production programme for dairy cattle
- The inclusion of feeds produced on the farm in dairy cattle rations
- Hygiene in the milking shed
- The rearing of calves

- The choice of crops
 - The planning of an irrigation farm
- Another object of this project was to have as many irrigation farmers as possible subscribe to the Departmental pamphlet series. So far 132 farmers have subscribed.

Investigation of the potential of agricultural resources in the Oudedagspruit and Brakspruit subcatchments.

The aim was to design land use systems for these areas as well as for individual farms.

- (a) The Oudedagspruit Subcatchment covers an area of 38 715 ha, with 34 farm units. During the year under review the last 17 farm units were planned and all but three of the farm plans were approved. In all 98 km of waterways and 150 km of inner camp fencing have been approved and so far 4 km and 28 km respectively have been completed. In addition 22 standard and 49 non-standard stock-watering points were recommended and four have been completed.
- (b) The Brakspruit Subcatchment covers an area of 44 716 ha, with 35 farm units, for 11 of

which planning has been completed and land use systems recommended.

Evaluation of the Stock Reduction Scheme

The project concerning the evaluation of the effects of the Stock Reduction Scheme on the veld and the productivity of livestock were completed by 30 June 1976. The following are some of the most important conclusions for the Jansenville extension ward:

(a) *Evaluation of the effect of the Stock Reduction Scheme on the veld*

- (i) During the period 1972 to 1976 the basal plant cover on the farms of all the collaborators increased to 3,4 per cent, which is an increase of 168 per cent. The crown cover increased to 27,43 per cent - an increase of 96,25 per cent.
The basal and crown cover of the grass scrub, tree and shrub components all increased.
- (ii) The basal plant cover on the farms of the participants increased to 4,07 per cent (an



A group of ladies of a women's agricultural union being informed about the research work done at the different sections at the Elsenburg College of Agriculture

increase of 211 per cent), as against a cover of 2,91 per cent on the farms of non-participants, which represents an increase of 126 per cent.

- (iii) The crown on the farms of participants increased to 28,2 per cent (an increase of 100%); on the farms of non-participants it increased to 27,54% - an increase of 95%.
- (iv) With regard to the plant groups of the greatest economic importance, the participants had a greater basal and crown increase in all cases than the non-participants, except in the case of the perennial grasses.

For instance, the basal cover of palatable trees and shrubs, which constitute a very important component of the veld in the extension ward, showed a higher increase in the case of participants (0,10%) than in the case of the non-participants (0,05%).

The basal increase of palatable brush species was 0,92% on the farms of participants and 0,46% for non-participants, but the opposite was true in the case of perennial grasses, where the participants had an increase of 0,26% and the non-participants an increase of 0,78%.

- (v) The conclusion is that the grazing has improved very significantly since 1972, as a result of generally favourable weather conditions and better veld utilisation practices.
- (vi) The Stock Reduction Scheme also played an important part in the promotion of improved veld utilisation practices. The veld of participants in the Stock Reduction Scheme has shown greater improvement over the period 1972 to 1976 than that of non-participants.

(b) Evaluation of the productivity of livestock as a result of participation in the Stock Reduction Scheme

In view of the fact that the managerial ability of the participants in the Scheme and that of the non-participants, the climatic conditions during the period and the condition and size of the farm units are highly comparable, the following conclusions may be drawn:

- (i) The Scheme fulfilled an important function in that it boosted and stabilised animal production because more favourable nutritional conditions were created and management practices generally improved.
- (ii) The data reflect satisfactory production results in both groups.
- (iii) Participants in the Scheme attained better production results during the period in question (1972/1976) than non-participants.

The participants achieved an annual gross income of R23 454 per respondent, leaving grants received from the Stock Reduction Scheme out of account, as against R20 029 per respondent for the non-participants.

On an area basis gross incomes were R5,78/ha and R5,24/ha, in the favour of the participants. The average gross income, according

to the actual number of small stock units (SSU) kept, but excluding grants from the Stock Reduction Scheme, was R18,35/SSU in the case of the participants, as against R14,31/SSU for the non-participants.

The participants produced more wool and mohair per animal and also sold more livestock.

Over the period the participants sold an average of 41,7% of the actual number of small stock units kept, as against 23,3% in the case of the non-participants.

FREE STATE REGION

Programmed extension activities in this Region centre around -

- production techniques and the study of yield standards
- study groups
- subcatchment development and protection

(a) Production techniques and the study of yield standards

The purpose of the study is to compile a series of standards based on soil series or resource units, using case studies on the farms of selected collaborators. This study is being given top priority in the Region and is being undertaken in all six subregions. Both crop farming and livestock enterprises are being included in the study.

Number of collaborators and standards studies in the various subregions

Subregion	Number of collaborators
South-Eastern Free State	57
South-Western Free State	20
Central Free State	140
Griqualand West	42
Gordonia	7
Bechuanaland	12
Total	273

The number of collaborators is still being increased so that all the most important branches of farming can be covered by the study. The case studies have given rise to the development of techniques by means of which yield data can be accurately reflected. Farmers accept the data readily and consequently regard the extension advice given as a result of the studies as reliable.

(b) Study groups

Study groups are responsible for a large number of extension activities. Attendance figures for members are good and the study groups are active. In addition to keeping mail-in records, members of study groups give time to a number of vital matters such as fertilising, cultivation, cultivars, planting times, stock diseases, supplementation, overwintering and soil potential.

Study groups are nuclear groups of farmers to whom extension is given and by whom information is effectively disseminated among other farmers.

Number of study groups per subregion (Free State Region), activities and meetings

Subregion	Number of study groups	Number of members	Activities	Number of meetings
South-Eastern Free State	3	28	Mail-in records	9
South-Western Free State	10	72	Mail-in records, field husbandry, small stock	36
Central Free State	8	76	Mail-in records, field husbandry, livestock	71
Griqualand West	15	162	Mail-in records, crops, livestock	74
Gordonia	3	25	Mail-in records, livestock	4
Bechuanaland	6	54	Mail-in records, grazing	20
Total	45	417		214

More effective use of study groups is therefore regarded as one of the first tasks of the extension service.

(c) Subcatchment development and protection

In the Nuwejaarspruit, Slykspruit and Egmont Subcatchments, which are situated in the South-Eastern Free State Subregion, the planning of farms has either been completed or is at an advanced stage. The proposed soil conservation works are gradually being constructed by the owner.

Although fairly good progress has been made with hedges and stock-watering points, the protection of lands and veld management practices require far more attention. Extension programmes in the subcatchments are therefore aimed at persuading farmers to construct the proposed soil conservation works. Programme planning committees consisting of farmer members from the subcatchment areas are responsible for drawing up these programmes and carrying them out under the guidance of the extension staff.

HIGHVELD REGION

The chief task of the Department is planned agricultural development according to the principles of optimum land use and there has been a real breakthrough in this Region during the year under review. On the basis of the resource data collected in seven development areas and the available physical and economic production standards, it was possible to draw up nine extension programmes and start putting them into practice.

The programmes make provision for the following:

- (a) Physical planning on the farm level, with particular attention to:
 - the grouping of land units according to yield potential
 - the withdrawal of low-potential cropland
 - the ploughing of high-potential cropland that is still under natural veld
 - the classification of natural grazing according to palatability, slope, cover and erosion sensitivity classes.
- (b) Run-off control planning on an area and farm basis
- (c) Crop selection according to soil potential
- (d) Fertilising according to soil potential

(e) Cultural practices aimed at overcoming physical and chemical soil limitations

Although the extension programmes in the preferential development areas will be fully implemented only during the next growing season the following progress reports have already been received:

Out of a group of 38 farmers in the Vermaa development area (Lichtenburg district) 18 farmer have already fertilised some of their land according to potential. Preliminary surveys show that considerable yield increases were obtained where fertiliser was applied according to potential.

In the case of 12 farmers in the Argent development area (Delmas district) the re-grouping of lands according to potential has already been mapped out and accepted by the farmers. During the coming season these will be cultivated as separate land units.

Demonstrations of cultural practices aimed at overcoming physical and chemical limitations have been planned in the Argent development area and laid out.

The construction and establishment of waterways has been started on 20% of the farms in the Vlaktefontein development area (Ventersdorp district).

TRANSVAAL REGION

In the Transvaal Region two key programmes for agricultural development were registered, viz:

1. The development of adapted farming systems for the Transvaal Region (T-VL 35).
2. The communication of adapted farming systems and practices in the Transvaal Region (T-VL 36)

All extension programmes will be registered under these two key programmes in future. Of the 30 projects already registered, 27 fall under programme T-VL 35 and only three under programme T-VL 36. It is therefore clear that so far the emphasis has fallen on the determination of standards, and there will have to be a shift in emphasis to the communication of the information collected. These projects are aimed at pre-determined target areas or target audiences.

The development of adapted farming practices in the Koster, Eerstegoud, Vlooiop, Groot Olifants and Kafferspruit target areas has progressed very favourably during the past year.

The run-off control planning of most of the target areas progressed very favourably and it is now possible to move on to the communication stage.

Most of the basic physical data has been collected and charted in 20 target areas and in 15 target areas maintenance schedules have been completed in order to determine certain essential psycho-sociological data and gauge the situation with regard to the acceptance of practices. During the year under review most of the time was spent on compiling reports and interpreting data, and on determining economic and production standards.

During the year under review 173 000 ha of land was mapped, which brings the total for the Region to 336 250 ha.

The three communication projects completed with target audiences at Koedoesrand, Ellisras and Thabazimbi were successful, chiefly because the areas are fairly homogeneous, most of the farmers understand and feel strongly about the problems involved and a simple and straightforward message can be got across fairly easily.

SOUTH-WEST AFRICA REGION

(a) Farm competitions and extension

As a result of the encouragement from extension workers and members of soil conservation committees, who are fairly well represented on farmers' associations, good progress was made with farm competitions. Farm competitions are held on the farmers' association level. The winner receives a one-star award. The winners of the farmers' associations compete on a district union level. The winner here receives a two-star award. District union winners compete on a national level for the master conservation farmers' award. A farmers' day is held on the farm of each winner. A large proportion of the 66 farmers' days held in the Region during the year under review were held on the properties of farmers who had won farm competitions.

These farmers' days have great value from the point of view of extension and have already made a notable contribution to the development of farms and the application of improved farming practices.

The current situation in respect of one-star and two-star and master conservation farmers in the Region is as follows:

Number of master conservation farmers	Number of one-star farmers	Number of two-star farmers
24	62	12

During the year under review one farmer was elected a master conservation farmer.

(b) Newsletters

During the year under review 10 of the 16 extension offices sent newsletters to their farmers. Newsletters are used chiefly to promote extension programmes and carry news items of general interest. Members of soil conservation committees

are encouraged to write contributions to newsletters.

NATAL REGION

This Region wound up two projects, viz the beef project at Underberg and the dairy project at Newcastle.

At present the liaison projects of the Natal Region cover the following:

Subject	Number of registered projects
Beef production	4
Maize production	2
Soil protection	2
Extension investigations	1

(a) Progress with the beef production programmes in the Region may be summed up as follows:

(i) The feed estimate programme for 100 cattle farmers in the Underberg soil conservation district was concluded during the past year. During the five-year programme 108 farmers received their feed estimate plans. Soil samples were taken on 1 103 lands and 563 feed samples were analysed for protein, fibre and TDN content. The project is regarded as extremely successful.

(ii) The programme of economic intensification of beef production in the Swartberg area of Griqualand East, which included 28 farmers, has shown the following progress:

- Individual extension was given to seven farmers, and questionnaires were completed and information collected on the farms and beef production systems.
- Feed requirements of livestock were ascertained and the feed estimate for each of the farms worked out.
- The winter feed position was determined during late summer and provision made for the required supplementation.
- The mail-in records study group included in the project received their first analyses of figures and individual advice was given to six farmers in the programme area.

(iii) Other activities that centered around beef production inside and outside the programme area included the following:

- 2 farmers' days on beef production questions
- 2 newsletters on feed production
- 2 demonstrations on veld and artificial pastures
- 1 article in a local newspaper on soil and feed samples
- "beef workshop", attended by 10 farmers.

(b) The programme aimed at promoting maize production on the farms of 75 maize farmers in the Greytown extension ward showed very good progress.



Pupils regularly visit research institutes of the Department to increase their knowledge of agriculture. This group is being instructed on the functioning of a milking parlour

The soil conservation committee of Umvoti divided the programme area into four wards, under the supervision of a maize team, which had been appointed.

A statistical analysis of the survey carried out during the previous year showed that poor weed control and an inadequate plant stand were the chief limiting factors in maize cultivation in the Greytown extension ward.

The following project activities took place:

- 5 lectures on production costs and the chief findings of a maize survey;
- a newsletter on limiting factors in maize cultivation;
- a survey on cultural practices that included all the collaborators;
- 4 group discussions in each of the project wards on maize cultivation (very well attended);
- 2 meetings of the maize team to report progress;
- the compilation of a guide on maize production practices in the Greytown extension ward; and
- a farmers' day on maize production practices.

(c) The programme in the Winterton soil conservation district on improving maize yields by means of optimum fertilising and improved cultural practices made satisfactory progress.

Thirteen co-operative demonstrations took place and 31 farmers applied optimum fertilising on a whole-farm basis. Eighty-five farmers visited the co-operative demonstrations in two groups.

STUDY GROUPS AND PLANNING COMMITTEES

EASTERN CAPE REGION

Study groups are still functioning efficiently and are identifying problems in the various branches of farming and trying to find solutions. About 23 study groups with a membership of almost 270 are active throughout the Region. The study group still serves as a forum for farmers and officers.

KAROO REGION

In this Region there are 29 study groups, with a membership of 239, studying the profitability of farming. The basis of their calculations is the mail-in records system. During the year 87 meetings and gatherings, at which analysis sheets were discussed by regional economists, were held.

A further eight study groups with a membership of 55 have undertaken the study of various subjects, including lambing percentages, veld improvement, veld fires and drought-resistant forage crops.

a) *The Waterford-Jansenville economic study group* concentrated on agricultural financing during the year under review. Six members of the group worked out a comparison between the 1974/75 and 1976/77 production years and found that -

- the average net profit per ha increased from R4,37 to R11,10 - an increase of 154%;
- average farming expenditure per ha only increased from R3,08 to R3,95 - an increase of 28,2%;
- the lambing percentage of Angora goats rose from 78,4% to 81,3%; and
- the lambing percentage of Boer goats increased from 158,8% to 189,4%.

(b) *Members of the Carnarvon mail-in records study group* were able to make the following calculations from their records:

	Merinos	Dorpers
Total income	R15,28/LSU	R11,81/LSU
Direct costs	R 1,55/LSU	R 1,47/LSU
Gross profit	R13,73/LSU	R10,34/LSU
Lambing percentage	61,2%	118,7%
Weaning percentage	91,7%	82,8%
Mortality rate	4,4%	3,2%
Percentage of ewes in flock	60,7%	70,8%

The results are slightly lower than average for the Karoo Region and considerably lower than the average percentages of the best third in the Karoo Region.

On the basis of these results each farmer's enterprise was diagnosed in order to eliminate problems and shortcomings.

HIGHVELD REGION

During the year under review 22 study groups were active in the Region, the combined membership being 410. Together these study groups held 83 meetings. Subjects for study included the following: field crop production, economic planning, grazing control, beef production, deciduous fruit cultivation, land use and milk production.

The following examples illustrate the successes achieved:

A resource classification course was presented during the year under review under the aegis of the Ladybrand study group. In co-operation with officers of the local extension office, low-potential field crop soils are now being identified on the farms of members.

A planter for establishing pasture crops was purchased and the planting of legumes and grasses on soils withdrawn from cash crop cultivation has been started. The study group also placed an order at a nursery for large quantities of *Digitaria smutsii* grass seeds for planting on the farms of members.

The Argent study group planned co-operative demonstration trials to try to correct chemical and physical limitations in the field crop soils in the Argent development area. These include deep applications of lime to improve the acidity (pH) of the subsoil.

Attempts are also being made to produce a favourable calcium:magnesium ratio by applying gypsum.

At present nine programme planning committees, with a membership of 83, are actively engaged in carrying out extension programmes in the development areas.

SOUTH-WEST AFRICA REGION

At present there are 22 study groups in the Region. Members of soil conservation committees are involved in study groups as far as possible and are encouraged to play a leading part. Wherever possible the results and findings of study groups are conveyed to the farming community through publication in the newsletter of the extension officer concerned.

NATAL REGION

The 24 study groups of the Natal Region, with a membership of 376, met on 60 occasions during the year under review.

The following are among the key activities in which a few of the study groups and other committees have been engaged over the past year:

- The study group concerned with controlling bush encroachment, which co-ordinates with the soil conservation district committee of Tambotie, made good progress last year with laying out bush control trials in this area.
- The Melmoth beef study group made very good progress with the identification and solution of their problems. Over the past few years the business analysis of the group has shown great progress with regard to efficiency standards.
- The economic study group of Newcastle consists of eight members and has had very fruitful discussions with the regional economist.
- The soil conservation committees in the Natal Region are remaining active as programme planning committees. Over the past year 22 committees were involved in extension programmes.
- The Mkuze Valley irrigation scheme advisory committee is investigating brack problems on irrigation farms in the area.
- The Committee for the Controlled Use of Natural Resources Along the Zululand Coast made excellent progress with a survey and report that is to serve as a guide for this area.
- It is apparent from the data of the mail-in records study groups of Kokstad, Cedarville and Swartberg that the rising cost of beef and mutton production, combined with the more or less fixed income from meat production, and the lower income from milk as a result of the levy imposed by the Milk Board, will land many farmers in financial difficulties.

EXTENSION RESEARCH AND SURVEYS

KAROO REGION

(i) A survey was carried out in the Carnarvon extension ward which showed that although the veld is in good condition (possibly largely because of exceptionally favourable weather conditions) there are still various problems, including the following:

- Waterway veld is separately camped off on only 60% of farms.
- Only 31,2% of the waterways are receiving the recommended treatment, namely winter grazing.
- The camp:flock/herd ratio is not satisfactory, because on 53,8% of the farms there are only three camps per flock/herd and on 28,5% only four camps per flock/herd. The ideal is at least five camps per flock/herd.
- On 45% of the farms there are less than nine camps.
- The recommended long-term carrying capacity is maintained by only 16% of the farmers.
- 46,4% of the farmers are not resting one third of the grazing for 12 months - a general guideline under the Soil Conservation Act.

The overall result of these problems is that only 44,4% of the grazing is in good condition.

(ii) In the Jansenville extension ward the general practice is to apply rotational grazing and rest the veld, and the stocking rate is generally at an acceptable level.

A survey carried out from 1974 to 1976 by soil conservation committee members on the farms of 53,9% of the landowners in the ward, and covering 59% of the area, showed the following:

- 76,3% of the respondents rest veld for six months or longer.
- 90,8% of the respondents follow a grazing system which involves resting 33% or more of the veld at a time.

TRANSCVAAL REGION

The project on the efficiency of fresh milk farming in the South-Eastern Transvaal was concluded during the year under review.

The purpose of the project was to investigate the resource utilisation pattern and production efficiency in fresh milk farming in the South-Eastern Transvaal and identify problems in the industry so that extension priorities could be formulated.

A survey was carried out by means of coded interview schedules and the 68 fresh milk farmers in the area who were available for interviews were included.

Findings

Fresh milk is produced at a very low level of efficiency in the South-Eastern Transvaal. It appeared that 96% of the farmers do not obtain an average daily production of over 12 kg per cow and that 56% of the farmers even obtain less than

10 kilograms per cow per day. Furthermore, 59% of the fresh milk farmers do not succeed in obtaining a calving percentage of over 80% and 27% do not even exceed 60%. These low production and reproduction figures are a reflection of a generally low level of production efficiency. It was also found that feeding, selection and breeding practices, record-keeping, reproduction management, mastitis control measures, site lay-out and labour control were very inefficient.

This inefficient performance can be ascribed to the inability of the poorer farmers, in particular, to recognise the problems they are facing and evaluate them realistically. It was clear that there was a direct relationship between the drop in efficiency and the farmers' tendency to overestimate their efficiency and fail to recognise their true problems.

NATAL REGION

Systems development

A new trend, which involves bringing research and extension closer together, was set when the Region created the Systems Section. The aim is to combine technical knowledge, economic facts and the conditions on a given farm - usually by means of special computer programmes - in such a way that practical assistance can be given to farmers with decision-making and the management of their enterprises.

The facilities offered at present include a dairy enterprise simulator and a dairy cattle feeding programme, both of which are widely used by the dairy industry of Natal.

Other programmes at an advanced stage of development include a beef herd simulator, a weeping-love grass simulator and several farm and feed planning procedures. A soil loss and field crop planning system was developed in co-operation with the Rhodesian Department of Agriculture.

SUMMARY OF ACTIVITIES

Table 1 on the next page is a summary of the chief tasks performed by the extension staff of the regional organisations of the Department.

TRAINING

COLLEGES

Table 2 shows the number of students who took diploma courses at colleges of agriculture.

SHORT COURSES

Colleges of agriculture also make a great contribution to agricultural training through short courses presented both at the colleges and in the regions.

These activities are summed up in Table 3 on the next page.

In addition to the activities mentioned in Table 3, the Potchefstroom College of Agriculture and Highveld Regional Office received the following visitors who came to obtain information. See Table 4.

TABLE 1 - Individual contact with the public

Activity	Number
Individual visits	26 037
Telephone visits	11 453
Home visits	16 586
Postage	77 696
Group contact and activities	
Number of study groups	405
Total membership	4 337
Number of study group meetings held	1 906
Number of subjects dealt with by study groups	11
Number of programme planning committees	126
Number of collaborators	273
Number of participants in competitions	1 043
Number of competitions held in wards in which Departmental officers acted as judges	106
Soil conservation committee meetings	53
Farmers' days arranged	320
Courses presented	128
Demonstrations held	336
Regulatory activities	
Properties inspected for weeds	7 066
Notices served under the Weeds Act	717
Proceedings instituted	4
Re-inspection after notices	422
Surveys (contour)	8 358
Surveys (pipelines)	7 446
Surveys (other)	3 581 (works)
Miscellaneous	
Journeys: Self	3 792 210 km
Journeys: As passenger	1 635 085 km
Letters written	32 984
Reports written	7 661
Exhibitions attended	239

TABLE 2 - Student numbers at colleges of agriculture
(Numbers in brackets are those of the previous year)

College	Student numbers	
Cedara	127	(123)
Glen	79	(80)
Grootfontein	90	(90)
Neudam	33	(38)
Potchefstroom	132	(115)
Stellenbosch-Elsenburg	141	(135)

TABLE 3

College	Number of courses	Attendance
Cedara	12	239
Glen	24	487
Grootfontein	13	245
Potchefstroom	48	1 244
Stellenbosch-Elsenburg	11	462
Neudam	1	12
	109	2 689

During the year under review 990 persons visited the Institute - almost 51% more than during the previous year, when there were 628 visitors. This increase was due, *inter alia*, to the activities of the Summer Grain Centre during the past growing season.

TABLE 4

Visitors	Number of visits	Number of persons
Departmental	14	53
Overseas	4	15
Study groups	5	270
Private sector	15	211
Schools and teachers' training colleges	4	40
Universities	2	40
Total	44	990

In the Transvaal and Eastern Cape Regions, where there are no colleges of agriculture, the following extension work was carried out by research staff:

Activities	Transvaal Region	Eastern Cape Region
Farms visited	194	238
Farmers' days held	16	-
Lectures on farmers' days	-	53
Short courses presented	4	6
Demonstrations held	25	-
Judging at shows	5	5
Study groups and other meetings attended	44	50
Visitors to offices	739	522
Enquiries answered in writing	683	741
Enquiries dealt with over the telephone	-	1 086

AGRICULTURAL INFORMATION SERVICE

POPULAR PUBLICATIONS

Over 2½ million copies of pamphlets on various subjects were printed and distributed during the year under review. These comprised 233 pamphlets, the combined impression being 945 000 copies, and 401 reprinted pamphlets, with an impression of 1 309 500 copies. The pamphlet service is expanding all the time and about 50 000 names and addresses have been computerised. Pamphlets are dispatched automatically with the aid of modern equipment.

In addition 154 000 copies of the weekly newsletter *Agricultural News*, 62 600 copies of other newsletters intended for distribution in South Africa, 64 960 copies of agricultural reports, 16 350 copies of lectures given on farmers' days, library lists, guides and commentaries for slide series, 20 100 copies of the results of egg-laying tests, tests held under the National Milk Recording and Progeny Testing Scheme, and tests on mouldboard ploughs and sprinklers were printed and distributed.

Two editions of the publication on the use of pesticides and fungicides, one on the inquiry into the importation of poultry material and one on the inquiry into rural reform (two parts) were published. Two brochures, one on the Citrus and Subtropical Fruit Research Institute and the other on the Transvaal Region, were published. The

popular pamphlet *Beekeeping in South Africa* was also reprinted.

Pamphlets and periodicals to the value of R30 458,41 were sold during the year.

The annual report (1975/76), two issues of *Trends in the Agricultural Sector* and four issues of *Agrekon* were prepared for publication in both languages on behalf of the Department of Agricultural Economics and Marketing.

SCIENTIFIC PUBLICATIONS

AGROPLANTAE, AGROANIMALIA, AGROCHEMOPHYSICA, PHYTOPHYLACTICA

During the year 81 articles were received for these publications, which is 47 less than during the previous year. Together with a carry-over of 106 articles from the previous year, this made a total of 187 articles. Of this number 109 were approved, 6 rejected, 10 scrapped, 3 classified as technical communications, 1 withdrawn and 58 are still under consideration.

ONDERSTEPSPOORT JOURNAL OF VETERINARY RESEARCH

Four issues of this journal, viz Volumes 43(2), 43(3), 43(4) and 44(1), appeared during the year. Thirty-nine articles were received, and together with a carry-over of nine articles, 48 were therefore dealt with. Thirty-one were placed, nine reserved for Volume 44(2) and the remaining eight for Volume 44(3).

OTHER SCIENTIFIC PUBLICATIONS

Other scientific publications included:

Flowering Plants of Africa Volume 44, Parts 1 and 2; *Flora of Southern Africa* Vol. 16, Part 2, and Vol. 22; *Genera of Southern African Flowering Plants* Vol. 2, and a *Key to the Families and Index to the Genera of Southern African Flowering Plants*; *Botanical Survey Memoirs* No. 41 and *Bothalia* Volume 11, Nos. 1 and 2.

The *Logging Reference Manual*, Parts 1, 2 and 3, was published and 21 articles were prepared for publication in the *South African Forestry Journal* on behalf of the Department of Forestry.

AUDIO-VISUAL SERVICES

During the year under review 12 synchronised slide programmes were completed. The commentary on 12 programmes was prepared for printing and completed, and the commentary on 15 programmes was transferred to master tape and adapted where necessary. In some cases the commentary was interspersed with music and transferred to cassettes. Nineteen programmes were translated and 109 programmes are at various stages of completion.

Although it is difficult to determine how much use is actually made of the programmes, the slide programmes would appear to be becoming more popular. The number of programmes borrowed is decreasing as more programmes are

issued on permanent loan to bodies to which equipment has been made available.

Programmes were shown in the Division's auditorium on 19 occasions, and at other venues on five occasions. This is 12 more shows than last year. These shows were attended by about 150 persons.

Several lectures and demonstrations were given to bodies such as UNISA, the University of Pretoria, the Land Service Movement and Homeland Governments. Other bodies were assisted with the design, preparation and construction of exhibitions.

RADIO

During the year under review *Landbouradio/Calling All Farmers* made a major contribution to the Department's campaign to discourage the injudicious burning of veld by farmers and to make the general public aware of the consequences of veld fires.

These programmes, which daily touch on a wide variety of topical and other matters, continue to present a lively picture of the agricultural industry. Farmers, Organised Agriculture, agricultural scientists and experts in related disciplines make a big contribution here.

The radio's role in alerting farmers to various problems was again evident from the good response to programmes such as those of the Division of Agricultural Engineering, which resulted in the number of enquiries to the Division increasing sharply.

Optimum land use remains the basic theme of these programmes. Here the radio is supporting the Department's extension campaign, and research results are continually made available to farmers.

Calling All Farmers also succeeded in obtaining important contributions from other departments. Highly successful series of talks and other types of material were contributed by bodies such as the Departments of Health and National Education, Water Affairs and Forestry.

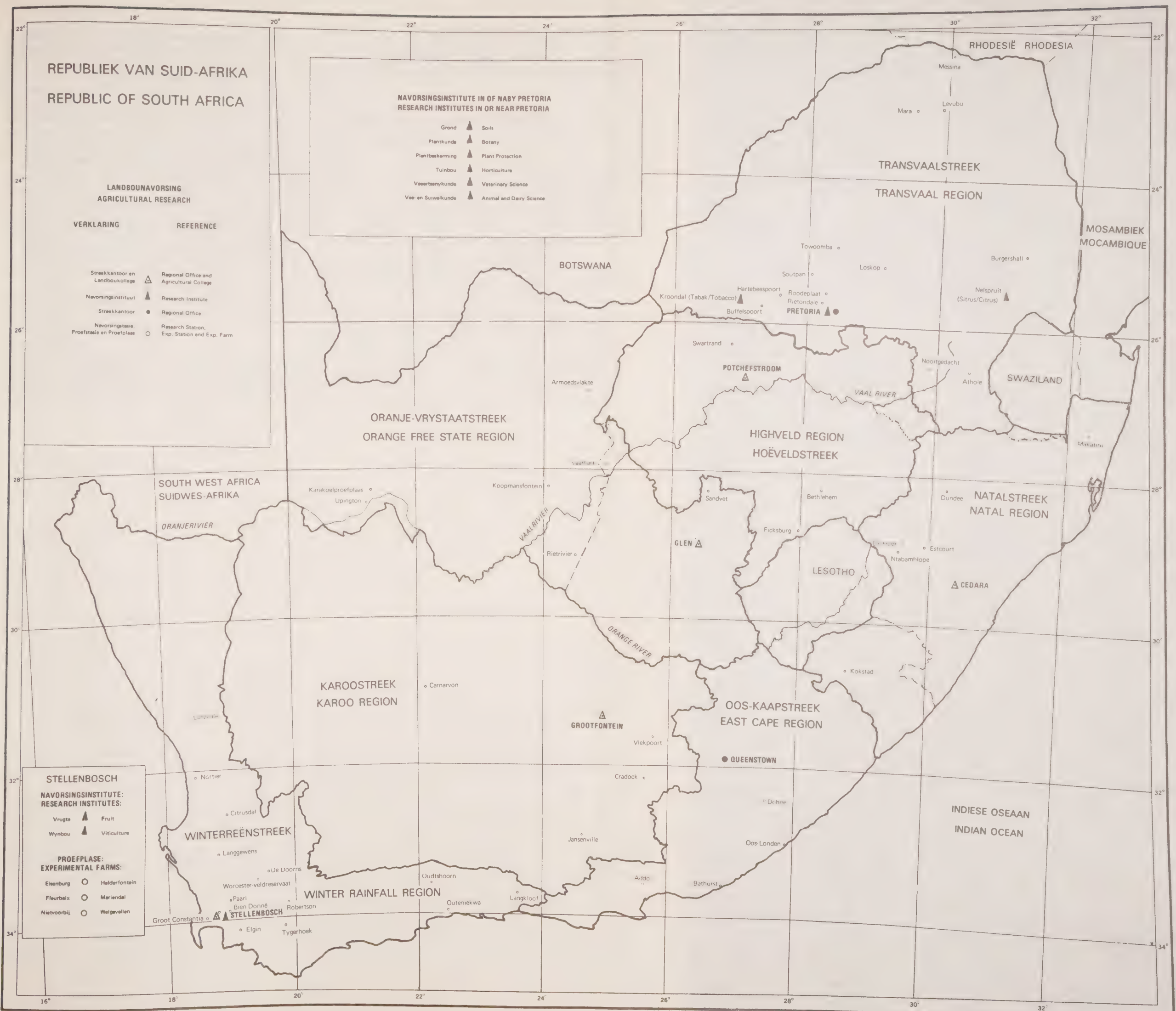
We should like to thank the SABC for their whole-hearted co-operation with the presentation of *Calling All Farmers* and their positive attitude towards the agricultural industry.

AGRICULTURAL NEWS

The rural press and agricultural journals made more use of reports appearing in *Agricultural News* during the year under review. The contents and the presentation of agricultural information in this newsletter not only comply with the requirements of these bodies but also enjoy considerable support from the agricultural sector and farmers. The column on new Departmental publications is already having an impact. The selective enlargement of the circulation of *Agricultural News* was continued.

AGRICULTURAL LIBRARIES

As a result of the increase in the prices of books and journals, far fewer publications were



REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

LANDBOONAVORSING
AGRICULTURAL RESEARCH

VERKLARING

REFERENCE

- | | | |
|--|---|--|
| Streekkantoor en Landboukollege | ▲ | Regional Office and Agricultural College |
| Navorsingsinstituut | ▲ | Research Institute |
| Streekkantoor | ● | Regional Office |
| Navorsingstasie, Proefstasie en Proefplaas | ○ | Research Station, Exp. Station and Exp. Farm |

NAVORSINGSINSTITUTE IN OF NABY PRETORIA
RESEARCH INSTITUTES IN OR NEAR PRETORIA

- | | | |
|--------------------|---|--------------------------|
| Grond | ▲ | Soils |
| Plantkunde | ▲ | Botany |
| Plantbeskerming | ▲ | Plant Protection |
| Tuinbou | ▲ | Horticulture |
| Veertsenykunde | ▲ | Veterinary Science |
| Vee-en Suivelkunde | ▲ | Animal and Dairy Science |

STELLENBOSCH

NAVORSINGSINSTITUTE:
RESEARCH INSTITUTES:

- | | | |
|--------|---|-------------|
| Vrugte | ▲ | Fruit |
| Wynbou | ▲ | Viticulture |

PROEFPLASE:
EXPERIMENTAL FARMS:

- | | | |
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| Fleurbaix | ○ | Mariendal |
| Nietvoorbij | ○ | Welgevallen |

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purchased by the Central Agricultural Library during the year under review. Despite this fact, there was an appreciable membership increase as reflected by the 50 307 issued publications as opposed to the 12 958 of the previous year. This increase could be ascribed to the regular radio talks on *Calling All Farmers* and the distribution of *Agrolibri* by means of which the library and its literature are brought to the attention of the public.

All the branch libraries, with the exception of the one in the South-West Africa Region, were visited during the year. Procedure sheets were provided for each branch library and most of the routine work was executed according to this. The standard of service of the branch libraries was satisfactory as a result of this guidance from the Central Agricultural Library, particularly because there have been few staff changes.

A new branch library was opened for the Plant Protection Research Institute and about 2 500 books and 238 journals were transferred from the Central Agricultural Library. There are now 19 branch libraries.

In collaboration with the library committee, the purpose and function of the library, as well as its relationship with the Division of Agricultural Information, are being reconsidered. The possible

use of new developments, for instance the computerised magnetic tape services of the Commonwealth Agricultural Bureaux, is also being investigated.

TRAINING OF AGRICULTURAL TECHNICIANS

The Department submitted a proposal to the Public Service Commission for the replacement of the present system of training by a bursary scheme similar to that in operation for professional staff. This proposal should effect a considerable reduction in expenditure on training and eliminate numerous other problems experienced at present.

The Pretoria College for Advanced Technical Education decided to establish advisory committees for the various fields in which it offers training. The purpose is to promote far closer liaison between the College and the various employers so that problems and needs can be identified on both sides. The foundation meeting of the Agricultural Advisory Committee was held on 8 June 1977 and Dr N. Robbertse and Mr J. Momsen were appointed as the representatives of the Department.

VI. Supporting Services

BOTANICAL RESEARCH

Seventy-two research publications on a wide variety of subjects appeared during the year under review.

Because the environmental crisis has intensified over the past year, it has become necessary to speed up taxonomic, ecological and economic research into our botanical resources in order to keep pace with the greater demands made by the planning of resources and the growing awareness of environmental problems.

Invader weeds and water plants, which have become a major threat, are requiring increased attention and the rapid deterioration and disappearance of natural vegetation are making the completion of ecological surveys on a national scale an urgent matter.

The Advisory Committee for Botanical Research, which was appointed by the Minister of Agriculture last year, is processing a report, originally compiled by the South African Association of Botanists, on the status of the botanical sciences in South Africa. The completed report will have a decisive effect on the development of botany, both inside and outside the Department.

FLORA RESEARCH

Flora of Southern Africa

The following two parts were published: Volume 16, Caesalpinioideae and Volume 22, Ochnaceae to Cactaceae.

A new series on cryptogams has been started and the first volume, on Characeae, is ready for printing. The new format for the series is being printed at present.

Good progress was made in the following plant groups:

1. *Juncaceae*. Work on the family, which is represented by 20 species, is far advanced.
2. *Ornithogalum*. A revision of this large genus is ready for the printers.
3. *Loranthaceae* and *Viscaceae* were completed and are being prepared for printing.
4. *Crassulaceae*. A monograph of the genus *Crassula* is in the final stages of publication. A summarised account of the 26 species and 24 sub-specific taxa of *Adromischus* was written up. The new genus *Tylecodon*, also with 26 species, was split off *Cotyledon* and prepared for publication. A draft of the genus

Cotyledon is complete, except for a final assessment of the *C. orbiculata* complex. Preliminary accounts have been completed for 7 out of 12 species of the genus *Kalanchoe*.

5. *Malvaceae*. Keys to the genera and to most species have been finalised.
6. *Hermannia*. Ninety of the 140 species of the genus have been written up and a key to them has been completed. Work on the remaining 50 species is progressing steadily.
7. *Asclepiadaceae*. Work on the genus *Brachystelma* has brought to light several new species, most of which have been published. Progress was made with the difficult genus *Ceropegia* and with *Riocreuxia*.

Botanical Collectors

The compilation of biographical and historical information on collectors in Southern Africa has been completed up to and including those whose names begin with T.

Genera of Southern African Flowering Plants

With the appearance of Volume 2 (Monocotyledons) this work is now complete. The key to the families and the index have been made available as a separate brochure.

Register of plant taxonomic projects

To facilitate planning and co-ordinating work on the Flora of Southern Africa a register of projects is being compiled. It aims to reflect all research at present in progress anywhere in the world which has relevance to Southern Africa.

Bibliography of South African Botany

A work comprising some 10 000 references to publications on South African botany published up to 1951 has been sent to the printers and should appear early in 1978. The references are mostly to taxonomic publications.

Southern African Place Names

A list of some 42 000 place names was published. The material is presented according to the Degree Reference System widely used by biologists.

Southern African Plants

The first number of a series of one-page brochures has appeared. It deals with the *manketti*,

A print of aloes, red-hot poker and wild garlic from the popular guide on the flora of Pretoria now in preparation



ROSEMARY ROOS

Ricinodendron rautanenii. Further numbers are in preparation.

Eastern Transvaal appears to indicate that the climate of that time was more arid than today.

Pretoria Flora

The geographical scope of the work has been increased to include some species of surrounding districts and the title *Flora of South-Central Transvaal* has been proposed. A total of 408 species was figured and keys to these plants were written.

Grass anatomy

The so-called C4 pathway, which certain grasses employ to fix their photosynthetic carbon, appears to make them more competitive under arid conditions. In the winter rainfall area and on the high mountains most species exhibit the non-specialised C3 pathway. Numerous photosynthetic types were detected in grasses by anatomical studies. They were plotted on tables and described with a view to publication.

The discovery of C4 type grasses in cave deposits with an age of 80 000 years B.P. from the

Cytogenetics of *Eragrostis curvula*

Material was collected from the entire distribution area of this species, with the exception of Lesotho, and chromosome numbers were determined from about 700 specimens. A tendency to low chromosome numbers was observed in the higher lying areas, whereas high numbers are more generally found in lower lying areas. With the aid of about 350 meiosis analyses, certain subpopulations have already been distinguished. Seven fully sexual plants, which must have originated from at least four different populations, have already been found.

Lincoln Officer, Kew

Some 120 plant specimens which could not be identified in South Africa were studied and named. Specialist information was provided for botanists in South Africa. While taxonomists at Kew were assisted with various problems relating to the South

African flora. Research undertaken included revisionary studies in the genus *Ficinia* (Cyperaceae) and an investigation into the identity of *Opuntia aurantiaca*, the jointed cactus.

ECONOMIC BOTANY

Palaeo-ethno-botany

Over the past three years the Botanical Research Institute has been engaged in identifying plant remains from Border Cave and from other archaeological sites.

The significance of the identifications from Border Cave are still being evaluated. But it is already evident from floristic differences in the various strata of the deposit that significant climatic changes have taken place in the area during the last 70 000 years.

Identifications of plant remains from two further sites in the Eastern Transvaal and Natal have been undertaken, and evidence of the early cultivation of grain sorghum, maize and legumes has been obtained.

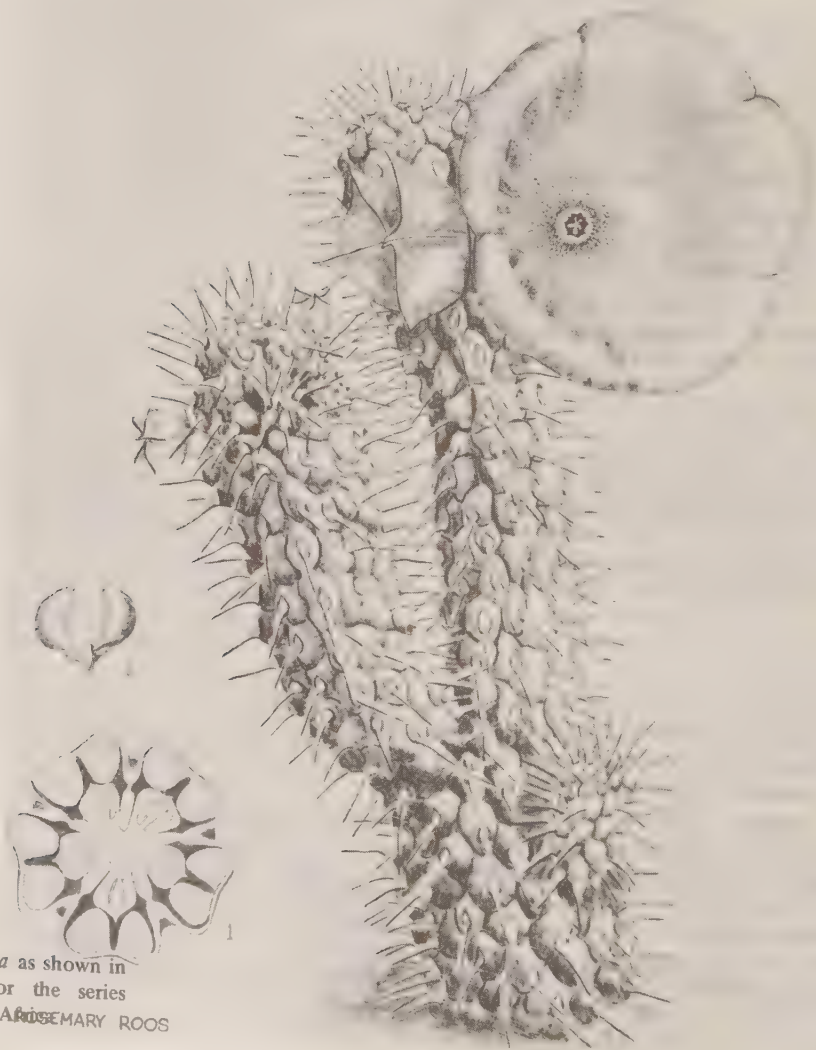
Ethno-botany

A start has been made on a survey of plants used by extant indigenous peoples. The first stage of this project deals with the Tsonga peoples of the far Northern Transvaal. To date, about 100 plants and their uses have been identified and correlated with their vernacular names and other relevant data.

The research results are being channelled in order to (a) help interpret plant remains found at archaeological sites, (b) expand knowledge of plants that can be used for survival, and (c) contribute to the general plant exploration programme, which is aimed at finding economic uses for our indigenous plants.

Plant exploration

At present work is being concentrated in two fields: a search for indigenous ground covers, sand binders, hedge, shade and timber plants, and a search for plants active against cancers. The search for cover plants is being initiated in the far Northern Transvaal.



A species of *Hoodia* as shown in a colour print for the series Flowering Plants of Africa ROOS

Cancer research

Seven hundred samples of South African plants, weighing about 1 000 kg, were collected and shipped to the USA for screening for activity against cancer. In addition, 8 400 g of seed of various species was sent for screening.

Our involvement in the initial stages of this screening programme is now coming to an end, and we are now concentrating on the collection in bulk and cultivation of promising species that are undergoing clinical trials.

Nassella research

A detailed survey of the spread of *Stipa richotoma* (nassella tussock) in the Hogsback - Happy Valley area was carried out in conjunction with the Eastern Cape Region. Since the last ground survey was carried out in 1972, the area known to be infected with nassella tussock has doubled in places. Some of this increased area can be ascribed to better survey coverage, but there is no doubt that the infestation has extended its boundaries by several kilometres northwards towards Whittlesea.

Lantana camara

Preliminary field and cytological investigations have confirmed the hybrid nature of the *Lantana camara* L. complex.

Other alien invaders

A survey is being carried out to establish which species of *Prosopis* (mesquite) are invasive in the dry central areas of South Africa.

Preliminary findings indicate that three species, provisionally identified as *P. pubescens*, *P. velutina* and *P. glandulosa*, occur in the area. The two latter species, both of which are planted to provide fodder and shade, are the worst invaders. Their potential area of spread has still to be established.

The editing of a handbook to aid in the recognition and control of alien invaders in the Cape vegetation was undertaken at the request of the Cape Provincial Department of Nature Conservation. Twenty-seven of the worst alien invader species are illustrated and described, together with advice on control measures. This work has been completed up to the pre-publication stages.

Distribution of trees in the Transvaal

An improved base map showing the physical features of the Transvaal has been completed and is now being used for plotting the distribution of each of the 900 woody species occurring in the Transvaal. Habitat factors and abundance are also being plotted on newly designed standard sheets that will, together with the maps, provide an atlas guide to the distribution of indigenous tree species in the Transvaal.

Economic botany data bank

A start has been made on developing a data bank of economic information on South African plants. The aim of this project is to ensure that proper use is made of existing information both for research and in the answering of enquiries. To date some 845 books, articles and unpublished letters, reports and theses have been scanned and abstracted. Good progress has been made in the compilation of a list of key words that will ultimately allow the abstracted information to be stored in and retrieved from the Department's computer system.

This project covers all economic aspects of plant use, ranging from ethno-botany to the isolation of chemical compounds, and also includes weeds science.

Scientific information service

The Botanical Research Institute receives hundreds of queries every year covering a wide variety of botanical and allied agricultural subjects. A scientific information officer has been appointed to co-ordinate this service, with the result that considerably greater efficiency has been achieved.

Poisonous plants

Special emphasis has been placed on gathering and making abstracts of information about poisonous plants, and the literature on 352 poisonous plant species has been dealt with to date. This literature survey includes letters and other references on the files of Professor Douw Steyn, who was for many years in charge of the Toxicology and Pharmacology Section at Onderstepoort. Approximately one-third of his references have been incorporated in the data bank.

A field guide to the identification of poisonous plants has been completed and is in press.

HERBARIUM AND INFORMATION SERVICES

Information

A record number of 35 100 plant specimens was identified for officers of the Institute, various Government and provincial departments, universities, and the public. One important function of the herbaria has been the supply of records for surveys of rare and endangered species in the Cape and Transvaal. It is hoped that, with the encoding now completed, the retrieval programme will soon follow to provide a rapid information service which, up to now, has been extremely time-consuming.

Development

A total of 25 100 specimens was added to the five herbaria of the Institute - the National Herbarium in Pretoria and the regional herbaria in



Mimetes hottentoticus, a rare and endangered species of the Proteaceae in the South-Western Cape

Durban, Grahamstown, Stellenbosch and Windhoek. Collecting expeditions were undertaken by members to remote areas of South-West Africa and Lesotho to increase knowledge of the flora.

Mosses

For the first time the Institute and South Africa have the services of a qualified bryologist, from the USA. He is currently engaged in updating and checking the collection of 14 000 specimens in the National Herbarium and the several thousand in the regional herbaria. His presence here has resulted in a marked increase in interest and activity in mosses throughout the country.

Research

Taxonomic research by staff of the herbaria is continuing in a wide spectrum of plant groups: Fabaceae, Cyperaceae, Poaceae, Ericaceae, Hypoxidaceae, Geraniaceae and mosses.

Revision of *Mariscus* in South Africa

The past year has been devoted largely to the tracing of type material in other local and overseas herbaria, the lending of herbarium material and the

examination of borrowed material. It was possible to trace and borrow a large number of type specimens in the *Bulbocaulis* group, but less success was achieved in the case of the *Umbellales* group. The borrowed herbarium material largely confirmed the conclusions of the researcher and made it possible to refine and add to present findings.

The subgenus *Campylla* of the genus *Pelargonium*

Herbarium specimens were borrowed from South African and several overseas herbaria. The specimens and the literature were studied. The preliminary findings include one name change, viz. *Pelargonium tricolor* (Andr.) Curt. becomes *P. violareum* Jacq. Volatile oils are being quantitatively examined by means of gas chromatography.

P. violareum populations which differ in the shape of the flowers produce almost identical graphs. The anatomy of leaf stalks is being studied and three types are found, namely cylindrical, with four primary vascular bundles and a concentric central bundle, adaxially flattened, four primary vascular bundles, with sclerenchyma caps, adaxially

grooved, three to four primary bundles with a sclerenchyma ring.

Classification of the South African Poaceae

Work continued on the treatment of the 224 species of grasses for the Flora of South-Central Transvaal. Descriptive keys to 140 species and illustrations of 40 species were completed.

Studies in the genus *Pentaschistis* are continuing. Problem taxa were investigated in the South-Western Cape, Natal and Lesotho, and literature from Kew and the British Museum was studied. Two species have been finalised and written up. Studies so far indicate the need for a division into winter- and summer-rainfall groups of species.

PRETORIA NATIONAL BOTANIC GARDEN

The Garden is functioning increasingly as a place where indigenous plants are grown and planted for research and study purposes. Five hundred of the 900 tree species that occur in South Africa are already represented in the Garden. The trees are used for study purposes by the Institute, universities and other bodies. Ecological planning with the object of giving each plant its own place, as far as possible, has been completed. The result of the protection of the natural vegetation on the hills can be seen at closer quarters now that footpaths have been provided.

A start has been made on laying out a border around the Garden. When the plants are in bloom, the area already completed illustrates the colourful variety of South African plants.

The ornamental ponds, which will be used for South African water plants, were again sealed to make them water-tight and suitable plants were planted in the surrounding area. An attractive and functional entrance that is appropriate to the general plan was laid out at the northern side of the Garden. Good progress was made with work on the water supply, the paving of roads, and fencing. About 1000 m² of roads was paved and the completion of the fencing has meant that the site is better protected.

The scientific collection in the Garden has been supplemented by the planting of 145 species of trees and shrubs, and 60 000 plants were supplied from the nursery to provide colour, help protect the soil or for the borders.

During the year under review 1367 new collections were recorded. These include a collection of plants from the mountainous areas of the Transvaal, which were visited by helicopter, a collection of seeds from the Cape Province, plants for study purposes such as *Lantana camara* and plants for the Division of Economic Botany. The plants recorded were labelled and 600 new nameplates were placed in the Garden.

ECOLOGICAL RESEARCH AND SURVEYS

South African savanna ecosystem project

Detailed information on statistical variation of biomass data for all woody species has been prepared. Not only is there a breakdown into the important biomass components, such as leaf mass, twig mass, branchwood mass and deadwood mass, for all shrubs and trees, but also the way in which each of these categories varies for different sites within mixed bushveld vegetation. It is now possible to specify more precisely the elements of the ecological role of woody species in bushveld savanna.

Seasonal rates of change in terminal growth of woody species have been monitored for six of the more important species. In addition, radial rates of change of tree trunks as well as changes in leaf area were also monitored throughout the season. With available biomass relations, the seasonal changes can be expressed per unit of ground area, which is essential for integrating these data with that of other concurrent ecological research within the project. It is now clear that radial growth of stem and branches makes up a significant part of the total plant growth above ground during any season.

A new facet of research undertaken is to measure the rate and seasonal timing of growth in *Ochna pulchra* and *Burkea africana*. In due course, cores of wood from the trunk and branches of individual trees will be taken at monthly intervals and examined microscopically to obtain a measure of the growth which has occurred. Pilot studies have commenced on how to establish datum points, in order to establish where the cores should be taken and also how to match up the cores for comparison.

Where to take cores presents problems, because growth in both these species is markedly eccentric, a phenomenon normally associated with slope. Comparison of cores also poses problems. Results obtained from staining techniques have had only limited success.

Western Transvaal survey

The field work of the Western Transvaal Bushveld survey has been completed. All field data have been classified phytosociologically in accordance with the Braun-Blanquet approach with much help from electronic data processing. About 34 plant communities are being described in the basis 515 sampling plots and a total of over 1000 plant species. Interesting distribution patterns are also being revealed. *Sutera griquenses* was recorded for the first time in the Transvaal near Groot-Marico. *Acacia erubescens* seems to prefer magnetite outcrops where it grows in dense stands.

Zululand coastal dunes

Elaboration and evaluation of field data and writing up of the results of this and the previous

The Tsongas of the Northern Transvaal use four indigenous plants for making these baskets, namely *Acacia gataxacantha*, *Brachylaena discolor*, *Tecoma capensis* and *Dioscorea rotinifolia*.



year are now bringing the first phase of this project to an end. The report will now be used as a basis for regional planning, especially in relation to mining operations.

Cape mountain fynbos surveys

Vegetation survey of the Cape of Good Hope Nature Reserve

During the original field work a concurrent survey determined the extent of infestation with alien pest-plants. As part of a monitoring programme at ten-year intervals a start was made this year on a re-survey of the pest-plant infestation. From the 50% samples so far enumerated it appears that infestation has seriously increased.

A primary survey of Rooiberg Mountain Catchment Reserve near Ladismith

Reconnaissance was completed and nearly half the reserve was mapped in physiognomic-structural units. Only two major units can be distinguished in mountain fynbos: the mid-high closed restioid communities on predominantly north-facing slopes and the tall dense proteoid communities on predominantly south-facing slopes.

Reconnaissance survey of mountain fynbos

Ideas for a physiognomic classification embodying typification of fynbos by its most distinctive physiognomic features - the restioid, ericoid and proteoid growth forms - were refined and tested at 19 localities between the Cedarberg in the north-west and the Suurberg in the east.

Distribution and autecology of *Hakea* pest plants

A questionnaire has been designed to determine the distribution of *Hakea* infestations. The phenology of *Hakea* growth is being studied at two field sites by means of tags and seedlings being grown in pots to permit study of the root system. A method to determine the fruit production of *Hakea* for an area has been devised and is being tested.

Cape coastal fynbos surveys

Semi-detailed survey of the vegetation of the Western and Southern Cape coastal lowlands

The preliminary distribution range of the main invasive alien *Acacia* species has been determined and mapped on the quarter-degree grid through the Cape.

Field data from the Cape Flats, Mitchell's Plain housing development and adjacent areas have been collated, standardised and preliminarily ordered into phytosociological tables. Twenty terrestrial plant communities were identified and described in the Langebaan area. A map showing the distribution of these communities was produced.

The Cape Hangklip vegetation survey project has been terminated and the editing of papers on this study for publication purposes has reached various stages.

- (i) The provisional check list of the flowering plants and ferns has been published.
- (ii) A paper on the application of Association-Analysis, Homogeneity Functions and Braun-Blanquet techniques in the description of this vegetation is in the press (Bothalia).

(iii) The description of the vegetation is in the press (Bothalia).

Monitoring the growth, phenology and population density of *Orothamnus zeyheri*, the marsh rose, in the Kogelberg State Forest continues. A confidential research report was produced for the National Programme of Environmental Sciences.

Aquatic ecology

Natural lakes and pans, large dams, reservoirs and farm dams, in general not smaller than 5 hectares in area, were surveyed for aquatic macrophytes. Vegetation data obtained were synthesised and classified using a Braun-Blanquet approach. The communities delineated in the classification table reflected a decreasing pH and conductivity gradient.

The fieldwork phase of the reconnaissance survey of aquatic macrophyte vegetation has been completed. A preliminary report on the survey has been prepared.

Research into the growth kinetics of *Eichhornia crassipes* for nutrient removal by mechanical harvesting was initially slow until the classification and mapping of the aquatic macrophyte communities of Natal was completed. Several constants (maximum specific growth rate, half-saturation constant and yield coefficient) were determined for *E. crassipes*.

From the growth constants and yield coefficients the minimum standing crop required to utilise the available nutrient can be derived and expressed in terms of mass or area, as determined from the literature. The yield coefficient is used to derive the growth potential and from the growth rates at various temperatures and levels of nutrient supply the time taken to produce the yield can be estimated. The harvesting frequency is determined, based on an observation that a commercial harvester can process 47 metric tons daily.

Joint South Africa - Botswana *Salvinia molesta* (Kariba weed) survey and pilot control projects in the Linyanti - Kwando River System

Monitoring was continued of the spread of *Salvinia molesta* (Kariba weed) in the Linyanti-Kwando River System on the Caprivi - Botswana border region, together with respraying of trial areas. Because of the possibility of re-infestation from sources higher up in the rivers outside the Caprivi and Botswana territories, and because of the terrain problem that makes complete eradication impossible at present, the preliminary field trials have been directed towards control and suppression of the overall level of infestation of the weed and ultimately towards control by biological agents.

Although the boat-based measures adopted by both Botswana and South Africa in the new 1974 infestation of *Salvinia* in the Kwando River section have markedly suppressed growth of the weed, terrain conditions prevent complete eradication.

The weed thus continues to spread slowly down the Kwando River.

Results of the second round of aerial spraying with paraquat herbicide have substantiated those of the first set. Spraying has been effective for river, pond and lake habitats. A major section of the Linyanti River that was previously blocked is now open, as is a large reed-enclosed trial area on lake Liambezi. Invasion and regrowth, however, are rapid from the surrounding reedswamp where, as expected, the efficacy of aerial spraying is severely reduced by the plant canopy.

Regrowth after autumn or late summer spraying appears somewhat less than after early summer spraying. No serious side-effects from the use of the particular herbicide and of the nutrient release and anaerobic conditions resulting from plant decay have so far been observed.

Initial work by the Botswana biologists on biological control agents have been promising in that the acrydids grasshopper, *Paulinia acuminata*, has been able to survive and reproduce under the conditions prevailing in the Linyanti River area. The usefulness of *Paulinia* and other biological control agents will probably lie in their use in conjunction with herbicidal spraying programmes. Such programmes, which will be necessary to reduce the large amount of weed mass present, will inevitably leave small patches of *Salvinia* that will act as foci of re-infestation.

DATA PROCESSING

All 480 000 Southern African specimens housed in the National Herbarium, Pretoria, when encoding started have been processed and a start has been made on the material which has arrived since encoding was initiated. Programming has been slow and beset with many difficulties, but somewhat more than two-thirds of the programs necessary for the retrieval of herbarium information have now been written.

Among the programs which have most recently become available are those for writing herbarium labels, writing short and extended notes on specimens and writing check lists of specimens by scientific name, common name and collector. Programs are under development for automatic identification of plants, writing of plants descriptions, writing identification keys for use in the field and, finally, group-forming.

The Data Section has developed a complete set of programs for manipulating Braun-Blanquet tables and these are in great demand by ecologists both within and outside the Institute. Two modelling packages are in frequent use for the development of mathematical models for the Savanna Ecosystem Project.

PUBLICATIONS

Bothalia

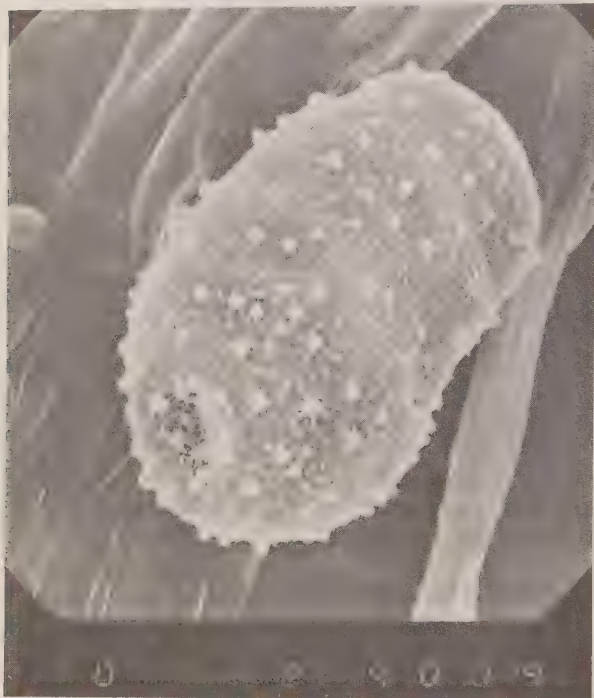
Volume 12, 6 appeared in print in October 1976 and proofs of Volume 12, 2 were corrected. The typescript of Volume 12, 3 was prepared for the press.

Flowering Plants of Africa

Volume 44, 2 and 3 appeared in print in March 1977, while Volume 44, 3 and 4 went to press in December 1976.

Memoirs of the Botanical Survey of South Africa

Memoir No. 41 went to press and three further memoirs are ready to go to press.



A spore of *Pithomyces chartarum*, a toxin-producing fungus that occurs on pasture crops and causes mortality among animals

PROTECTIVE RESEARCH PLANT PATHOLOGY

Cold conditions during the active growing season promoted the widespread incidence of virus diseases in commercial pome and drupe orchards. Fruit symptoms were pronounced on apples and pears and the fruit quality was impaired.

The large-scale infection of orchards with pear stony pit again emphasised the dangers attached to the injudicious topworking of established pear trees onto susceptible cultivars. Strains of pear stony pit that attack the supposedly resistant cultivar Bon Chrétien were found locally.

Improved tracing techniques for virus diseases of deciduous fruit and vines are being investigated in order to avoid the delays caused by the seasonal nature of field indexing.

The tracing of re-infections of fan leaf virus in the early stages, after soil fumigation, will make a direct contribution to the permanent reclamation of fan leaf-infected vineyard soils in the Western Cape.

The progressive death of hanepoot and sultana vines in the Orange River area over the past few years, which has already assumed epidemic proportions in some cases, has now finally been ascribed to a crown gall infection. The important discovery that vines can be systemically infected with crown gall bacteria has made it possible to investigate possible control measures. To this end a study of the various properties of the organism is being undertaken. The results will be used in comparative studies of various isolates with a view to the biological control of the disease, as in the case of drupes.

The origin and therefore the quarantine status of *Phytophthora cinnamomi*, the fungus causing root and collar rot of many horticultural crops, forest and fynbos species in the Cape Province, remains unresolved. If *P. cinnamomi* has been recently introduced to this area, it has spread far and quickly. It has been recovered from many different, infected host plants (both indigenous and exotic) from locations all over the South-Western and Eastern Cape, including geographically isolated and remote areas.

Rivers appear to be a significant natural means of spread, since high levels of *P. cinnamomi* have been isolated from many Southern Cape river systems, including the agriculturally important Berg, Eerste and Breede Rivers.

The most important artificial means of spread is through infected nursery material. *Phytophthora* root rot continues to be a problem in grapevine nurseries on Richter 99 rootstocks. Even though grapevine is not considered to be very susceptible to *P. cinnamomi*, severe losses have sometimes occurred in young R99 vineyards and in R99 mother plantations as a result of infected material being planted out.

A hot-water treatment has been developed which completely eradicates *P. cinnamomi* from rooted nursery material and from cuttings.

In a survey of the incidence of *P. cinnamomi* root rot in Cape Province forest nurseries, the fungus was isolated from diseased nursery material from all but one of the nurseries surveyed. A programme of control measures for forest nurseries has been developed and evaluated.

P. cinnamomi is an even greater problem on the highly susceptible Proteaceae. *Phytophthora* root and collar rot is the most significant disease problem facing the commercial protea production and exporting industry.

The disease also causes many losses, sometimes of irreplaceable genetic material, in botanic and other natural gardens. A programme of measures to control *P. cinnamomi* on natural and cultivated proteas and in protea nurseries has been developed and is being evaluated.

The ecological implications of *P. cinnamomi* for the fynbos and the many susceptible indigenous species it comprises have yet to be determined.

Research on plant pathology in the Free State Region was concentrated chiefly on the leaf spot problem in groundnuts. Under favourable environmental conditions the two pathogens that

cause leaf spot in groundnuts, namely *Cercospora arachidicola* and *Phoma arachidicola*, can be responsible for major crop losses.

Cercospora arachidicola can be successfully controlled by means of fungicides, but the chemical control of *Phoma arachidicola* has not so far been very successful.

Sixteen fungicides were tested in order to establish whether there is a fungicide that can control *Phoma arachidicola* successfully. From the end of November 1976 to the end of March 1977 the groundnuts were sprayed weekly with the preparations, at the recommended dose.

The rainfall during the first part of the season was far lower than during the corresponding period of the previous season.

The groundnuts were lifted 150 and 170 days after planting and the hay, pod and kernel masses were determined. About half the fungicides produced considerably higher pod and kernel yields than the control, and six of the preparations produced considerably higher hay masses than the control. Only one of the four preparations that resulted in the highest yields has been registered as yet.

Wheat

Sufficient rust inoculum was prepared in the Winter Rainfall Region for the testing, at the seedling stage, of the most promising strains of the Department of Crops and Pastures of the University of Stellenbosch. This aspect of the work is very important since this makes it possible to eliminate susceptible material at an early stage.

During the year under review there was the following co-operation with overseas nurseries:

International Spring Wheat Rust Nursery (ISWRN)

720 wheat strains were artificially inoculated with a mixture of rust strains, and 62 of the 720 were selected during the 1977 trials.

Isepton of Mexico

30 strains were selected.

International Bread Wheat Screening Nursery (IBWSN)

152 of the 386 strains were selected.

Septoria disease of wheat in the Winter Rainfall Region - This research can be summarised as follows:

All existing techniques in connection with inoculum production, evaluation systems and inoculation methods are being tested in order to adapt them to local conditions. Several other aspects are being studied. All new material planted annually at Langgewens is now being subjected to strict seedling tests in the glasshouse. This is an attempt to improve the identification of resistance and/or tolerance in respect of *Septoria*, and success already seems likely.

Lupins

Powdery mildew in lupins again occurred during the late flowering stage. The results showed that this disease has no adverse effect on yield when it appears during this stage and then follows a normal development curve.

A new systemic preparation, triadimefon, applied at a concentration of 250 g of active ingredient per ha, provided very good control of the disease for 43 days or longer after application. Fluotrimazole, a non-systemic preparation, also produced good results. Both preparations have a long residual action and are significantly better than vine sulphur. It is now possible to control powdery mildew by chemical means. The cost of triadimefon and the fact that the pathogen is capable of building up resistance against the preparation will influence its use.

Vegetables

Since 1976 there has been a tremendous increase in the incidence of downy mildew in cucurbits, including cucumbers and muskmelons, and in tomatoes. More than ever before diseases are spreading to early plantings in open cultivation, especially where no adequate control measures have been taken in tunnels. *Sclerotinia* white rot and *Botrytis* are also very severe in the tunnels. This may be ascribed to the fact that conditions are very moist when these crops are grown in tunnels out of season and when cold weather makes good ventilation impossible.

Mycology

A total of 1045 fungi were identified for workers in other Institutes and Regions of the Department as well as at universities and in the private sector. Among these fungi were the following interesting or economically important species:

Fusarium solani, *Stemphylium botryosum* and *Pleiochaeta setosa* on lupins from the South-Western Cape; *Fusarium coccophilum* on red scale of citrus from the Eastern Transvaal; *Cercosporidium personatum* and *Leptosphaerulina arachidicola* on groundnut from Vaalharts; *Leptosphaerulina briosiana* on lucerne from Middelburg, Cape Province, and Ermelo; *Melanconium* sp. on vine leaves from Johannesburg; *Phytophthora cinnamomi* on peach, *Cytospora leucostoma* on apple and *Gloeosporium amygdalinum* on almond, all from the Western Cape Province.

On maize leaves from Pietermaritzburg, *Drechslera maydis*, *Pithomyces chartarum* and *Diplodia macrospora* were found, the latter species in association with extensive leaf lesions. *Peronospora manshurica* was recorded from soyabeans from Natal for the first time.

Toxic fungi in stock feeds

Seventy-four samples of stock feeds suspected of causing poisoning in animals were examined for

the presence of toxic fungi.

These included a sample of sorghum beer residue from which *Aspergillus clavatus* was identified as the dominant fungus; feed pellets for horses, from which *Aspergillus clavatus*, *A. flavus*, *A. ochraceus* and *F. moniliforme* were identified; ergots of *Claviceps paspali* on the grass *Paspalum dilatatum*; and maize samples which were heavily infected with the cob rot fungi *Fusarium moniliforme*, *F. graminearum* and *Diplodia maydis*.

A field outbreak of a case of photosensitisation in cattle was investigated. On specimens of *Lolium perenne* from the artificial pastures on which the animals had been grazing, *Pithomyces chartarum* was isolated. This fungus was capable of producing the toxin sporidesmin when grown in pure culture. It is now well established that this fungus is widely distributed throughout Southern Africa.

Seed-borne fungi

Eight samples of rice seed from the Plant Quarantine Station at Buffelspoort, East Caprivi, Swaziland and Lesotho were examined. *Phoma glumorum*, *Pithomyces chartarum*, *Fusarium moniliforme*, *Pyricularia oryzae* and *Chaetomium funiculum* were the important fungi identified on them.

A sample of soyabean seed from the Eastern Transvaal had *Alternaria alternata* as the dominant fungus on poor quality seeds, while a few seeds were infected by a small-spored *Colletotrichum* species and *Ascochyta* species.

One sample of lupin seed was relatively free from fungus infection, but had *Stemphylium botryosum* as a seed-borne pathogen.

On *Lolium perenne* seed imported from New Zealand the fungus *Pithomyces chartarum* was found to infect a low percentage of seeds, thus indicating the possible transmission of a fungus known to be toxic to farm stock.

A large number of samples of maize seed are being examined for cob-rotting fungi. *Fusarium moniliforme*, *Fusarium graminearum* and other undetermined species of *Fusarium* have been found to be dominant on the specimens examined so far. *Diplodia maydis* also occurred on certain samples and the investigation is being continued.

Taxonomy and mycofloral survey

A study of the species of *Colletotrichum* in South Africa has been initiated. To date, a total of 75 isolates of the fungus has been collected from a surprisingly wide range of hosts which include clover, lucerne, groundnut, soyabean, velvet bean, mango, leaves of sweet potato, walnut, the grass *Dactylis glomerata*, *Erythrina humeana*, and *Combretum erythrophyllum*. The morphology of the species on the host material and in culture on different media is being studied.

The study of the fungi associated with the pasture grass *Cenchrus ciliaris* was continued during the year. A total of 61 116 Hyphomycetes were identified and counted on the leaves. These

fungi represent 65 genera or 140 taxonomic entities. Of these, 58 entities were new records for South Africa. The genera that occurred most frequently were *Alternaria*, *Cladosporium*, *Epicoccum* and *Nigrospora*.

Some genera occurred on all the leaf types studied, whilst others were restricted to certain types. *Curvularia* and *Drechslera* were most common on living leaves. *Helicomyces*, *Monacrosporium* and *Sporidesmium* were restricted to dead leaves and occurred mainly on the litter, while *Periconia* occurred in large numbers on frost-killed leaves.

Although various pathogenic genera such as *Curvularia*, *Drechslera* and *Fusarium* occurred, conspicuous lesions have not been observed throughout the duration of the survey.

Curatorial work

During the year a total of 50 specimens were sent out on loan to workers in herbaria overseas.

A total of 101 specimens were deposited in the mycological herbarium by workers in this Section and from other institutions during the course of the year.

Development of quarantine facilities at Buffelspoort

It was possible to acquire a lot of the necessary equipment and implements, and to erect a glasshouse with 11 rooms, an ancillary building, a fibreglass greenhouse and a water and irrigation plant.

Quarantine

The existing facilities at Buffelspoort were used for the quarantine of a number of varieties of imported seed of 11 crops. Some of these have been retained by the Department since 1973 because they did not have complete phytosanitary cover. Of the 253 samples, it has been possible to release 154.

Data bank

Considerable progress has been made with the building up and maintenance of a data bank on plant pathogens that occur both locally and overseas, and with the tracing and elimination of these organisms.

This information is of decisive importance in the imposition of phytosanitary import restrictions and quarantine measures, and there are already a few thousand cards with the necessary cross-references in respect of, *inter alia*, the scientific and common names of pathogens, host plants, range, degree of pathogenicity, tracing techniques and preventive measures. Although still incomplete, the data bank has already proved very useful.

Groundnuts are easily damaged in handling and a bucket elevator was designed to eliminate this problem. This is a prototype being tested at present



ENTOMOLOGICAL AND OTHER

Termites

The former head of the National Collection of Insects (NCI), Dr W.G.H. Coaton, who during his career had built up in Pretoria the world's largest African termite collection, retired in September 1976. He has, however, agreed to carry on his systematic studies which in the year covered by this report included reviews of the Southern African species of the genera *Porotermes*, *Pseudacanthotermes*, *Stolotermes* and *Termes* (Parts 12 to 15 of the National Survey of Isoptera series). The publication of Parts 13 and 14 has been somewhat delayed for lack of funds at the publishers (in Windhoek).

A Western African species of the genus *Allodontermes* has been characterised as generically distinct from three other species, which include three junior synonyms and range in geographical distribution from Eastern Africa to the Cape Province.

At the urgent request of a Dutch publisher a summary of the hitherto established facts of termite distribution and ecology was prepared for inclusion in a book on the biogeography and ecology of Southern Africa.

Routine determinations of Isoptera, including 37 samples submitted by the public, amounted to 280 series. With 19 determined *Odontotermes* subsamples donated from Sri Lanka and four African countries beyond the scope of the National Survey, the annual increment to the collection stands at 262 series, bringing the total of termite samples in the NCI to 32 783 on 30 June 1977. Eighteen genera are represented.

Severe budgetary restrictions have limited the extent of field survey trips. Only three short ones could be undertaken to the Northern Transvaal, the emphasis being shifted as in the previous year from extensive to intensive collecting.

The search for termitophiles, another main objective of intensive collecting, involved 28 nests of six termite host species and yielded altogether 767 specimens in 65 series, as follows:

Cubitermes transvaalensis (Fuller), 2 nests, 25 specimens, 2 series; *Macrotermes natalensis* (Haviland), 11, 626, 37; *M. ukuzii* (Fuller), 2, 16, 3; *M. michaelsoni* (Sjöstedt), 11, 81, 21; *Odontotermes badius* (Haviland), 1, 18, 1; *Trinervitermes trinervoides* (Sjöstedt), 1 specimen.

The 1976/77 termitophile increment is noteworthy in two respects: First, it involved two host species which hitherto had failed to yield any termitophiles, viz. *Macrotermes michaelsoni* and *M. ukuzii*. Second, the variety of elements collected was greater than in the previous year. Included were 6 specimens of Isopoda, 10 of Pseudoscorpionida, 6 of Thysanura, 9 of Orthoptera: Blattodea, one (nymph) of Homoptera: Cicadoidea, one of Homoptera: Cicadelloidea, 58 of Diptera: Phoridae, the bulk of the increment being once again made up of Coleoptera (672 Staphylinidae, 4 of other families).

During the year under review 145 determined specimens of termitophilous Staphylinidae: Aleocharinae, with 10 species of which 5 had been described as new, were returned to Pretoria by Prof. D.H. Kistner of California State University and transferred to the General Collection, NCI. Included were 4 holotypes and 20 paratypes. A specimen of myrmecophilous Paussidae (*Paussus bohemanni* (Westwood)), which had been collected by the NCI surveyors in the Northern Transvaal, was donated to the Musée Royal de l'Afrique Centrale, Tervuren, Belgium, at the request of Dr P. Basilewsky, head of the Department of Zoology.

Potato tuber moth

The correction factors for the loss of efficiency of extraction of potato tuber moth larvae from potato leaf and stem samples of increasing weight are now satisfactory, even though the variability of the data makes only approximations possible. Work is proceeding on the development of correction factors for the change of tuber moth larvae from earlier to later instars during extraction.

This problem is evident as a progressive accumulation of tuber moth larvae in later instars with increasing sample weight in data already corrected for loss of efficiency of extraction. In the case of the first instar, loss through change to later instars during extraction ranges from 33% (in leaf samples weighing between 100 g and 200 g) to 57% (in leaf samples of between 600 g and 900 g).

Broodryk found earlier that the potato tuber moth has four larval instars marked by four separate and clearly defined peaks in the frequency distribution of larval head capsule measurements. The present work showed a fifth peak, possibly caused by the presence of a partial fifth instar or by sexual or other dimorphism in fourth instar larvae. A comparison with the data of Broodryk led to the inclusion of this fifth peak with the fourth instar, to create a bimodal frequency distribution in this instar.

The efficiency of extraction of the other fauna such as aphids, thrips, etc., occurring with tuber moth larvae shows a marked decrease with

increasing sample weight. The efficiency of extraction of aphids, thrips and anthocorids is close to 100% in leaf samples between 100 and 200 g weight, but falls to only about 10% with leaf samples of about 500 g weight.

Work on this aspect is only in an early stage, but the development of reasonable correction factors for the other fauna may help in understanding the impact of predation on tuber moth larvae.

Work in the coming year will be directed towards developing and improving the correction factors, until the effort involved in their application is justified.

Carpenter bees

The available data on nesting substrates of carpenter bees was examined to obtain a better insight into the relationship of the numbers and distribution of these bees and the availability of nesting sites. The role of nesting wood and other factors in species formation in *Xylocopa* was also examined.

In all of 11 cases of natural populations of *Xylocopa* examined, the nesting substrate was found to be considerably under-utilised. Although *Xylocopa* apparently often does not utilise its nesting substrates fully in nature it is limited by the spatial availability of nesting substrates. While a few *Xylocopa* species are specialised even to the extent of structural modifications such as specialised mandibles probably suitable only for pithy stems, the majority of species will apparently use any nesting substrate available.

Different *Xylocopa* species are limited to nesting substrates of different maximum hardness and often make abortive attempts to excavate nests in wood too hard for them in their search for suitable nesting sites. The majority of *Xylocopa* species do not select nesting substrates, but utilise whatever is available. It is evidently this availability of nesting substrates which governs the distribution and speciation of *Xylocopa* species.

The frequent under-utilisation of nesting substrates in suitable areas suggests a limiting factor other than the availability of nesting substrates in these areas.

Mealybugs and soft scales

- (a) No field surveys were carried out during the year under review.
- (b) February and part of March 1977 were spent mostly on moving, resettling and reorganizing the coccoid collections and the work to arrange them in a single unit is continuing.
- (c) The observations on two podal structures in mealybugs have been completed and the data gathered are being worked out.
- (d) Work on some wax scales has been extended to include a few species belonging to sundry genera, the validity of a few of which is being reviewed.
- (e) Many old, loose slides as well as many lots of material - either stored in alcohol or dried -

have been restrained or mounted, identified and incorporated in the National Collection of Coccoidea.

- (f) Routine identifications and advice have been supplied to institutions and researchers in South Africa as well as in the United States (Texas), Australia, New Zealand, Italy, Rhodesia, Greece, India and Israel. Cochineals from Colombia, Mexico and Argentina have been identified for the Weed Laboratory in Uitenhage.

Thysanoptera - thrips

An article on two new species of South African thrips was completed and a review on the Hydiiothripinae of the world compiled.

World-wide contact was established with thrips specialists and as a result over 250 new reprints on thrips were acquired. Fifty-six new thrips species were added to our collection through exchanges. Bibliographies and the thrips collection as a whole were improved. Hundreds of thrips specimens were added to the collection.

Identifications of importance to the agricultural industry included the following: *Scirtothrips aurantii* Faure on *Bauhinia galpini* for the Letaba Citrus Estate, *Scolothrips hartwigi* Priesner on the cotton mite at Groblersdal for the Transvaal Region, *Frankliniella schultzei* Trybom on carnations for the Horticultural Research Institute, *Heliothrips sylvanus* Faure on vines for the Winter Rainfall Region, and *Thrips exilicornis* Hood on bunches of young banana fruit for the Citrus and Subtropical Fruit Research Institute.

Assistance was obtained from abroad and foreign institutions were also assisted. Thirty-seven named thrips specimens and 12 types essential for comparisons were requested and borrowed from England, Germany, France, Japan and Australia. The loans have been finalised. The British Museum in London borrowed 18 types and returned them. 418 thrips mounts were received back from Frankfurt, Germany, where they had been on loan for use for about 10 years. Dr. Shuji Okajima of Tokyo requested a guide to the genera of the Hydiiothripinae and the required information was supplied.

Diptera

Dacinae: The reappraisal of earlier ideas and the revision and arrangement of descriptions have been necessary. Work on less complex, major groups is near completion, but certain specialised and complex groups remain difficult, particularly when certain internal characters indicate differences of importance not apparent in the normal, external characters.

New name labels are typed as species become defined and the mere handling of material needs time.

It was suggested that use be made of the scanning microscope now available, but neither time nor material allows for extensive use of this medium. In a few experimental cases undertaken

the greatly enlarged pictures helped researchers to understand certain characters as seen under the ordinary microscope.

General. Specimens of the ceratitine, *Pardalaspis cosyra*, the marula fruitfly, were identified for the Citrus and Subtropical Fruit Research Institute, Nelspruit. It seems that the species is taking to new mango cultivars.

Specimens of cucurbit flies were identified for Dr Coutourier in Senegal.

Mr A. Freidberg is doing work on some tephritine flies allied to South African species. Further loan material was sent to him.

Hymenoptera parasites

New accessions

The expansion of the collections of the Encyrtidae and Aphelinidae, the two most important families on which work is in progress, was continued. Accessions in respect of which the hosts and host plants are known now stand at 5 125. The building up of the collection of other Chalcidoidea families, which was started about 18 months ago, is progressing well and 153 accessions were recorded. These include only specimens of which the hosts are known.

In addition to these accessions, about 8 000 specimens were collected by means of collecting nets, and 5 000 have been mounted and labelled. The collection is already the biggest of its kind in Africa. A large number of specimens of species of Proctotrupeoidea, a group of parasitic wasps of economic importance, were collected and sent for identification to Dr. L. Masner, National Collection of Insects, Canada. Some identified material has been received and is being housed in the National Collection. These specimens were collected in the course of two collecting trips to North Zululand and the Eastern Transvaal.

Identifications

Several identifications of parasitic wasps, associated with insect pests of importance in biological control programmes, were carried out. Some of these identifications were so important that the results were published. Identifications were undertaken for researchers in the Republic, Rhodesia, Mauritius, Réunion, Zaire, Israel, Greece, Turkey and the USA.

Taxonomic studies

A study on the new *Allotropia* species (Proctotrupeoidea: Platygasteridae), viz *Allotropia kamburovi* was completed and published. This insect appears to be potentially important in the biological control of the citrus mealybug *Planococcus citri*. *Allotropia* has already been bred in the laboratory and it is intended to export this species to Israel for purposes of biological control. The publication also contains notes on the biology of the parasite.

Two new *Ooencyrtus* species (Encyrtidae), which were used in the biological control of the

fruit-sucking moth *Othreis fullonia*, were described from New Caledonia and Samoa, two islands in the Pacific Ocean. A new *Metaphycus* species, viz *M. decussatus* (Encyrtidae), was described from Mauritius. This wasp appears to be an important parasite of *Pulvinaria iceryi*, a pest of sugar-cane.

A study on the Encyrtidae parasites of lac insects in Southern Africa was also completed and published. Two new genera and eight new species were described and over 70 references to localities, hosts and host plants were recorded. This is the first report on the parasitic wasps of lac insects in Africa. The successful use of the scanning microscope in the study of parasitic wasps was also illustrated in this study. A technique was developed which makes it possible to take high-quality photographs of these wasps.

A study was undertaken on the identity of the Eulophidae parasite, an important natural enemy of the citrus psylla *Trioza erythrae* in Africa. It appeared that this wasp had been erroneously identified previously: it is not *Tetrastichus radiatus* Waterston, as had been supposed, but another species. The correct identification of the wasp will eliminate the former confusion.

General collection

Insect research on Bruchidae (Coleoptera) associated with *Acacias*

This project forms part of an investigation into the possibility of using biological control for certain acacias. A survey is being carried out on the seed-eating beetles (Coleoptera: Bruchidae) that occur on acacias in South Africa; this survey consists chiefly in a taxonomic study of this group of insects. Samples of the pods of 30 of the 45 indigenous species of acacias have already been collected. About 6000 specimens have been bred from these samples, representing 22 Bruchidae species which attack 18 *Acacia* species.

Taxonomic studies of Neuroptera

Mr M. Mansell, formerly of Rhodes University, Grahamstown, has recently been appointed to the Plant Protection Research Institute. His collection of Neuroptera, possibly the biggest and one of the best in Africa, will be incorporated in the National Collection of Insects in Pretoria.

Collection of new accessions

During the year under review collecting trips were undertaken to Northern Zululand, the Eastern, Western and Northern Transvaal, the North-Western Cape and the southern part of South-West Africa. Although the chief aim of these trips was to collect specimens for the Bruchidae survey in acacias, a large number of specimens were also collected for the General Collection. Accessions for the General Collection were also obtained from light trap catches at Towoomba.

New accessions

In addition to the 6000 Bruchidae specimens, about 6000 specimens were collected for the General Collection during the above-mentioned trips and from light trap catches. About 1700 of these specimens have been mounted, labelled and classified into families. The mounted specimens represent 10 orders which include 75 families.

Identification service

The new identification service introduced 18 months ago is functioning very well and it has been unnecessary to make any changes in the system since the experimental stages. Seventy tasks have been performed since July 1976, involving the identification of 170 species.

Care of the general collection

The rearrangement of the Collection and its transference to unit cases, started a year ago, are progressing favourably. About half the Collection, i.e. 1120 trays, has already been reclassified and examined.

Liaison with the public

The function of the National Collection as a link with the public was clearly illustrated during the past year. Over 100 telephone queries on insects and entomological problems were dealt with. Twenty persons visited the Collection in connection with queries and a lecture on insects and the activities of the National Collection was presented to the Wild Life Society of South Africa.

Cotton research

Favourable conditions for cotton growing were experienced during the 1976/77 season.

Insect populations

- (a) *Vaalharts* - In contrast to the position in previous seasons there was a high population pressure of the American bollworm *Heliothis armigera* and the red bollworm *Diparopsis castaneum*. Chemical control measures had to be applied during the season. *Thrips tabaci* also occurred in large numbers, but no control measures were applied. Red spider *Tetranychus* spp. occurred late in the season and control measures were kept to a minimum. Other pests, such as spiny bollworm *Earias* spp., stainers *Dysdercus* spp., aphids and leaf feeders, were present throughout the year, although numbers were low.
- (b) *The Rust de Winter and Loskop Dam Irrigation Schemes* - American bollworm populations were relatively small during the first half of the season, but increased sharply from the middle of the season (end of January 1977) onwards. Spiny bollworm also occurred in large numbers at the end of the season, which necessitated additional spraying in

order to control the pest. Red spider infestations occurred, especially towards the end of the season, and chemical control measures were applied. Other pests occurred in small numbers.

Research results

- (a) The laboratory evaluation of several new pesticides for the control of the insect and mite complex as pests in cotton was continued this year. The evaluative process helped to get the preparation tetrachlorvinphos registered with the Department of Agricultural Technical Services during the year under review for the control of the bollworm complex. Another preparation, profenofos, was submitted for registration.
- (b) Final trials were carried out this year in order to determine at what stage after emergence a spraying programme for cotton should be started. The results indicate that when cotton is planted early in the season (middle of October) no control programme is required during the first eight weeks after emergence. If the insect populations are monitored, control programmes could be postponed for up to 10 weeks after emergence. In the Vaalharts Irrigation Area no control programme appears to be necessary for the first 10 weeks after emergence.
- (c) Insect surveys in cotton lands on the Loskop Dam and Rust De Winter Irrigation Schemes this season again indicated that spiny bollworm is becoming an increasingly common pest and that research aimed at introducing a control programme is essential.
- (d) Attempts to establish an imported egg parasite *Trichogramma pretiosum* in the Rust De Winter area were continued. During the season 77 500 parasites were released at intervals in a pesticide-free cotton land. The parasite was able to parasitise American bollworm eggs, but the numbers found were insignificantly low in comparison with those of a local parasite, *Telenomus* sp.
- (e) Light trap catches of moths were correlated with egg counts on plants in order to determine the American bollworm status of a cotton land. No correlation between moths and egg numbers per plant was found. In future researchers will concentrate on pheromone studies of the bollworm in order to help determine the American bollworm populations in an area. Research on the identification of the pheromone is in progress.
- (f) The following recommendations, based on research results, are generally accepted by producers:
 1. Thrips need not be controlled in the Vaalharts area.
 2. Where spraying is undertaken with a tractor and mist blower spray equipment, a spraying width of 14 metres can be chosen instead of the recommended eight metres.

3. No control of leaf feeders is necessary.
4. Where spraying is carried out with ultra-low volume manual equipment, only the recommended registered pesticide, namely carbaryl-molasses suspension, should be used.
5. It is important to monitor insects in cotton lands, as more and more producers are realising.

Natural enemies of the potato tuber moth

The efficacy of introduced parasites in controlling potato tuber moth was studied at 10 sites in the Southern Transvaal. Parasitism of moth larvae in potato fields reached the same high levels this year as last year, about 70% in December and 90% in January. Nevertheless, the crops were briefly infested by large numbers of moths in early January, shortly after a dry period.

There is now evidence that rainfall as well as parasitism regulates moth numbers and that a fall of less than 25 mm of rain in any fortnight is followed by a noticeable rise in moth numbers within a week. The crop can be protected by ridging or by one or two applications of insecticide. The insecticides do not reduce parasitism. About 90% of larval parasites are the two exotic species introduced some years ago.

Aphids

Preliminary work on an effective, integrated control programme for aphids in grain sorghum was completed during the past year. By using selective insecticides that attack the pest species but not the natural enemies, grain sorghum can be successfully grown with only one application of insecticide per season. Leaf spraying with endosulfan and pirimicarb provided excellent selective control of aphids, and these insecticides can be recommended for use against grain sorghum aphids. However, soil applications of the systemic granular formulations of carbofuran and pirimicarb are the best option for total integrated pest control on grain sorghum. Applied during planting, they provide total protection of the crop against aphids, and carbofuran in particular gives very good control (up to 87%) of stem caterpillars.

Trials to investigate the amount of harm aphids do to irrigated wheat were started. Large quantities of poison are used against aphids on this crop every year, but so far there is no experimental evidence that spraying is justified. Although several trials are already in progress, it is not possible to report on them at this stage.

Preliminary observations on the incidence and flight curves of several aphids of economic importance were started. The observations are carried out with the aid of sets of Moericke traps at Nelspruit, Sabie, Graskop, Groblersdal and Pretoria. These traps have already revealed that the black pine aphid appeared on pine plantations in the Eastern Transvaal in June, as in previous years.

An *in situ* investigation showed heavy infestations of the pine aphid in the Sabie area in July. An important observation was the almost complete absence of natural enemies of the aphid.

Stem borers

A comprehensive study to determine the pest status of the grain sorghum stem borer on grain sorghum in the Northern Transvaal was completed this year. It was apparent from this study that the period between emergence and the piping stage of the plant is the most sensitive to caterpillar damage, calculated on the basis of yield and plant growth. Infestations after the piping stage produced no significant decrease in either yield or plant growth.

Although the grain sorghum stem borer is capable of doing considerable damage to grain sorghum, chemical control measures are not economically justified at the moment. The reason is that the levels of infestation that occur in the land before the piping stage are very low.

It also became clear that there is very little parasitism of the grain sorghum stem borer. During the season the maize stalk borer was also investigated and it was found that parasitism is very low in this case as well. The possibility of importing exotic parasites to supplement the indigenous parasite complex is therefore being investigated.

Insects in stored products

The new grain protectant, pirimiphos methyl, which produced such good results in the laboratory on a small scale last year, was tested under practical conditions this year by spraying a silo tube full of maize with it. A second silo tube was treated with the standard preparation, mercaptothion, and a third silo left untreated. Maize in the silo treated with pirimiphos methyl remained free of insect infestation for the full trial period of 10 months. When samples of grain were removed from the silo treated with mercaptothion, which had been artificially infested with insects, it was found that the rust red flour beetle and the lesser grain borer had not been controlled; pirimiphos methyl was also unable to control the lesser grain borer. All the other insects in the trial were effectively controlled by both treatments. Since the lesser grain borer is a relatively insignificant pest of stored maize, pirimiphos methyl holds considerable promise as a protectant for maize. The cost of the pirimiphos methyl treatment was about equal to that of a single phosphine fumigation (and at least two per season are generally required) and about 2,5 times as much as the cost of a standard mercaptothion spraying.

Forest and timber insects

During November 1976 aerial spraying was carried out against the pine emperor moth *Nudaurelia cytherea* in the La Motte State Forest (Western Cape). A suspension of *Bacillus thuringiensis* was successfully used against the pest.

Pachypasa albofasciata defoliated young *Pinus radiata* trees in the Nieuweberg State Forest. This is the second successive occurrence of this pest in the plantations of the Western Cape.

Two new forest pests that attack *Pinus radiata* appeared during the year. An unidentified bark beetle of the genus *Ips* was found in several plantations in the Western Cape. This appears to be a secondary pest in young and medium-sized trees, but further research to determine the pest status of the insect is urgently required, since presumptive primary damage has recently been reported. A moth larva, probably belonging to the genus *Anua*, was responsible for the defoliation of 60 ha of young *P. radiata* in the Longmore State Forest in the Southern Cape.

The willow tree emperor moth *Gonimbrasia tyrreha* again defoliated thorn trees in the Little Karoo and the Langkloof. Since this moth destroys the only grazing for Angora goats and other small stock in the area, control measures were tested. The application of a suspension of *B. thuringiensis* at a concentration of half a kg per ha by means of a knapsack spray proved effective.

Following a visit to several research institutions engaged in research on timber insects and timber preservation in Europe, several changes were made in the breeding techniques of several timber insects in the local laboratory with a view to acquiring sufficient experimental insects. Researchers are concentrating chiefly on the European house borer (Italian beetle) *Hylotrupes bajulus* and the powder post beetle *Lyctus brunneus*. The latter was successfully bred on dog biscuits. Over 3 000 single cultures of *H. bajulus* were bred.

Investigations into the utilisation of *Porotermes africanus*, a timber-eating white ant from the Western Cape, as a laboratory insect for testing timber treated with various preservatives were continued. Several discussions were held with certain bodies, including the Department of Forestry, which are concerned with timber treatment and preservation. The regulatory aspects were discussed with a view to drawing up a more effective and practical set of regulations.

Beneficial insects

Honeybees

The Government Apiary in Pretoria is now known as the Bee Research Laboratory to emphasise its primarily research function. With the transfer of Dr D.J.C. Fletcher and Mr G.D. Tribe from Pietermaritzburg in October, the staff complement, which includes Mr M.F. Johannsmeier and Mr G.F. Pretorius, now stand at four.

In November a four-day bee breeding course, attended by 20 people, was conducted by bee geneticist, Prof. J. Woyke, from Poland and queen breeder, Mr R. Weaver, from the United States. Assistance was given to the SA Federation of Beekeepers' Associations in organising this course. Subsequently, AI has been practised at the

laboratory and various queen-rearing techniques are in process of evaluation.

The staff were also involved in organising an Apimondia International Symposium on the African Bee in November. Many people from Southern Africa and overseas countries attended this symposium and five of the 30 papers read were contributed by three staff members. These papers reflected current research results.

Upon request eight talks were given to beekeepers' organisations, three lectures at different universities, and one talk to school children. Information was also supplied to SATOUR for an article on beekeeping in South Africa requested by a Dutch magazine. Three articles were published in the South African Bee Journal and by invitation of the *Annual Review of Entomology* (a United States publication) a review entitled "The African Bee, *Apis mellifera adansonii*, in Africa" was prepared by Dr Fletcher. Mr Tribe assisted with the extensive literature search involved and Dr Fletcher spent one month in England gathering information from various libraries.

Insect control by viruses

All the instars of *Heliothis armigera* larvae were found to be susceptible to both the nuclear polyhedrosis virus (NPV) and granulosis virus (GV). An inverse relationship between mortality and larval age was found with the NPV-infected larvae, while the GV displayed a rather erratic mortality pattern. A degree of maturation immunity was found against the NPV, but not for the GV.

It was also found that pupation plays an important role in that it can prevent the lethal action of the NPV if infection takes place after a certain stage in the larval development. In the case of the GV, pupation cannot prevent the virus from killing the host, irrespective of when infection takes place.

The effect of simultaneous infection of the above two viruses was also investigated. It was found that a mixture of the two viruses caused by a lower rate of mortality than each of the viruses separately.

Biological control of prickly pear

The prickly-pear stem weevil *Metamasius* (formerly *Cactophagus*) *spinolae* continues to spread at a very slow rate at Springfield and Hankey. Quantitative assessment of its progress proved to be difficult.

Serious concern about the sharp increase of prickly pear infestations and regrowth in many cleared areas was felt generally during the last year. This increase seems to be the result of a temporary change in the climatic pattern (mainly rainfall) and/or a change of attitude of many Eastern Cape farmers regarding the pest status of the plant. Some farmers now actually encourage infestations on their farms.

This led to the question whether or not the two established insects on prickly pear, *Dactylopius*

opuntiae and *Cactoblastis cactorum*, could take care of these reinfestations, should other control measures be abandoned.

Six experimental plots throughout the Eastern Cape with young regrowth were selected for monitoring purposes. The population surveys are repeated at three-month intervals.

Although these quantitative surveys are of a long-term nature, it is already evident that *C. cactorum* is important in keeping regrowth at bay. At some localities the cochineal has disappeared altogether, although this insect was originally responsible for the total control of heavy infestations at these places. Reintroduction of cochineal to such reinfestations may be a useful step.

Biological control of jointed cactus

The jointed cactus stem weevil, *Metamasius fahraei*, which was introduced from Mexico in 1975 and 1976, has been reared in the laboratory on jointed cactus as well as on prickly pear stems. Rearing the insects on prickly pear stems proved to be far more practical than rearing them in large potted jointed cactus plants.

The entire third-generation culture was transferred to Rhodes University in October 1976. Research on this insect was thus discontinued at Uitenhage.

Mr H.E. Erb continued to ship *C. cactorum* eggs from different ecological regions and different hosts in Argentina. These cultures are eventually released on veld infestations of jointed cactus after having been reared and multiplied in quarantine at Uitenhage for at least three generations.

Studies on *Tucumania tapiacola*

Work on the pyralid moth *Tucumania tapiacola*, which is a potential biological control agent of jointed cactus, has now shifted from pre-release investigations to field release of the moth. The work is progressing on four major fronts:

Laboratory mass rearing of moths

Rearing techniques developed during pre-release investigations are being modified and adapted so that larger numbers of moths can be produced. This has been achieved by developing a parasite-free culture and by reducing the amount of handling of caged material to a minimum. Data on moth emergence, egg production and larval mortality are being accumulated so that the best rearing methods can be recognised and maintained.

Handling of laboratory-reared material

In order to use *T. tapiacola* most efficiently for mass releases, it is essential that the development of the moth can be controlled in the laboratory. The effect of low temperatures on egg incubation periods and percentage hatch is being investigated.

As a result, simultaneous hatching of batches of eggs laid over a long period of time can be ensured when larvae are most needed. Eggs can be kept in cold storage until such times.

Closely monitored, small-scale releases

Known numbers of *T. tapiacola* eggs have been glued individually to jointed cactus plants in three different regions of the Eastern Cape. The progress of each of these eggs and the larvae which they produce is being followed to determine the survival of *T. tapiacola* on jointed cactus in different areas.

The results obtained so far suggest that cooler winter temperatures have a detrimental effect on the eggs. However, more information must be gathered and comparisons with summer releases made to substantiate these deductions.

Mass releases of T. tapiacola

Attempts to establish *T. tapiacola* at three different localities have been made. As yet it is too early to determine the success of these attempts, but initial results indicate that larvae released in infested cladodes will have a better chance of establishment than egg batches placed in jointed cactus plants in the field.

Biological control of Hakea

The snout beetle *Erytenna consputa*, which destroyed young hakea fruit, has already been released at 74 localities in mountain ranges between Cape Town and Grahamstown. So far 68 of the localities were revisited for the annual determination of how far from the release sites the insects had ranged and for estimates of the population strength. Forty-eight colonies were classified as satisfactory, 34 were found to be weak as yet, no progeny was found at nine sites and 11 of the release sites had been destroyed or damaged by fires or other contingencies.

Extra beetles were imported in order to expand, supplement or replace existing releases.

Larvae of *Carposina autologa*, which destroy full-grown seeds, were bred on the largest possible scale in the laboratory with a view to releasing the young moths during early winter, and from April to June almost 500 moths were released near Stellenbosch, where attempts to establish the insect will be concentrated. Progress was made with better breeding techniques in order to make the artificial nutrient medium more suitable for the purpose.

A colony of *Erytenna binotata*, a beetle which may be of value in attacking hakea seedlings, was successfully established in quarantine in order to study the biology of the species, its potential as a natural enemy and its specificity.

The establishment and distribution of the hakea seed eaters are still at an early stage and numbers are still very limited. Other methods of eradication remain important, mainly because these insects do not destroy existing stands of hakea.

Biological control of St John's Wort (Hypericum perforatum)

Attempts to introduce and culture the rootborer *Agrilus hyperici* and *Aphis chloris* that may be of value in further suppressing St John's Wort where the beetle *Chrysolina gemellata* and the gall-midge *Zeuxidiplosis giardi* may not be totally and continuously effective, were continued, but no new releases were made. The midge *Z. giardi* was, however, again released near Tulbagh and new releases were also made at five small St John's wort infestations around Stellenbosch.

The spread of this weed has not stabilised and small new infestations outside the present known range were recorded. These are being watched to allow manual redistribution of the insects whenever warranted.

Lantana camara

Teleonemia scrupulosa was found in the Nelspruit area for the first time. Numbers of the two leaf miners *Octotoma scabripennis* and *Uroplata girardi* built up considerably on a pink *Lantana camara* at Margate, especially during the past summer season. However, the build-up was much slower at the other release sites at Nelspruit (pink *Lantana*) and Mt Edgecombe (both pink and orange *Lantana*). The longicorn beetle *Plagiohammus spinipennis* was established at Buffelspoort and Mt Edgecombe.

Acacias

A survey was carried out on the insects that attack *Acacia cyclops* A. Cunn. ex D. Don., *A. dealbata* Link., *A. decurrens* Willd., *A. longifolia* (Andr.) Willd., *A. mearnsii* De Wild., *A. melanoxylon* R. Br., *A. pycnantha* Benth. and *A. saligna* (Labill.) Wendl. in their natural environment (Australia). Over 1700 accession numbers were allocated to the insects collected. The most important enemies of these wattle species include several snout beetles that attack developing seeds and Hymenoptera, which cause galling of buds in certain wattles. In addition to these species there are another eight groups of insects that are regarded as important enemies of the wattle species. The rust fungus *Uromycladium tepperianum* (Sacc.) Mc Alp. is considered the most important single factor for the natural control of *A. saligna* in Australia.

The incidence of the black pine aphid *Cinara cronartii* Tissot & Pepper in plantations is receiving attention. A number of natural enemies have been collected.

Evaluation of D. Austrinus as a natural insect enemy

With the well-established sampling system running smoothly, it is still too early to draw definite conclusions regarding the causes of jointed cactus and cochineal population fluctuations in the

veld. Sampling commenced in January 1976. Nevertheless, the sampling system proved most useful in experiments evaluating the efficiency of the chemical control campaign and monitoring the effect of chemical spraying on the cochineal distribution and survival.

The following preliminary results can be mentioned:

1. The present chemical control campaign is most detrimental to the survival of the cochineal population and probably leads to almost total extinction after successive treatments. This, unfortunately, will make an integrated control approach difficult.
2. Contrary to general belief, no correlation could be found between vegetation cover and efficiency of chemical spraying; but
3. Efficiency of spraying is correlated with the jointed cactus population structure, efficiency being higher in aggregated infestations and lower in evenly distributed infestations.
4. On a density basis an average of 25% of all loose joints, 48% of small plants and 13% of medium-sized plants (5-10 joints) are missed after an intensive chemical spray treatment. The same treatment eliminated all large plants with 11 or more joints and this plant category also carried the bulk of the cochineal populations.
5. The abnormally high rainfall over the last 18 months may have been the cause of the sharp drop in the cochineal population throughout all the experimental areas.

Karoo caterpillar research

Fairly severe outbreaks of Karoo caterpillar larvae occurred in the western parts of the Karoo during the autumn of 1977, whilst only isolated and relatively mild infestations were recorded from the central and eastern parts. This has been characteristic over the past few seasons and probably correlates with climatic fluctuations. During the 1976/77 season the lowest numbers of adults were caught in a light trap which has been in operation since 1964.

Several generations of the Karoo caterpillar have been successfully reared on a synthetic diet and it has been possible to start a culture with adults which were collected as diapausing larvae.

Routine surveys have revealed that mortality following pupation is negligible.

PEST CONTROL

Locusts

The 1976/77 campaign against the brown locust *Locustana pardalina* was conducted on a fairly small scale.

Control measures were introduced on 13 September 1976 in the Vanrhynsdorp district. The campaign gathered momentum fairly rapidly and reached a peak in November 1976. At the end of December 1976 the campaign had, for all practical purposes, been concluded. There was a minor

revival in the Carnarvon district from the beginning of February to April 1977.

Twelve magisterial districts, chiefly in the western part of the Karoo, were concerned. These districts were Beaufort West, Calvinia, Carnarvon, Fraserburg, Hopetown, Kenhardt, Prieska, Springbok, Sutherland, Vanrhynsdorp, Victoria West and Williston.

The largest number of control units, viz 78, were in the field in November 1976. In all 18 980 hopper swarms and 1 344 flier swarms were destroyed. The total consumption of poison was 221 520 kg of 7% Gamma-BHC wettable powder.

Red locusts

There were no swarm reports for this species in Southern Africa during the year. The newly established Red Locust Control Service made extensive surveys of all red locust areas on the subcontinent, involving visits to South West Africa, Botswana, Rhodesia, Malawi and Zululand. Although scattered populations of locusts were encountered in most of these areas, no economic infestations were detected.

In East Africa, however, the hopper campaign waged in the Wembere Steppe was only partly successful during the 1975/76 season, and more than 13 swarms developed during the dry season. Most of these were subsequently sprayed in and on the fringes of the outbreak area, but some escaped north-westwards into Burundi.

Pesticide residues

The effect of the method of spraying on the precipitation and residual action of pesticides was investigated. Farmers are making increasing use of mechanical sprays and there are some doubts about the control obtained in this way. The undesirable residues caused by spraying equipment of this type are a cause for concern.

The effect of mechanical spraying on the precipitation and penetration of methidathion, parathion and monocrotophos was determined with citrus. Pesticides were applied to cotton with the aid of various types of tractor sprays and by means of aerial spraying. Preliminary results of a trial near Groblersdal have shown that the various types of spraying equipment produce different precipitations. These differences may influence the efficacy of bollworm and mite control. Low-volume manual spraying of vegetables is said to be increasing. The pesticides are generally sprayed at high concentrations and there is a danger of higher residues being found on vegetables after this kind of spraying. Preliminary results of a trial where low-volume manual spraying equipment was used on tomatoes show that the precipitation and residual action do not differ very much from those produced by ordinary manual spraying. It is possible that poor calibration of the spraying equipment would cause higher precipitation and consequently higher residues.

The effect the formulation of the pesticide has on the precipitation was investigated. Citrus trees

were sprayed with various formulations of parathion and methidathion and there are indications that the addition of a wetting agent could reduce the precipitation, but that there are few differences between the precipitations produced by the formulations. The uptake of soil-systemic preparations by the plant, and the control produced by a certain concentration of the pesticide, were also studied. The uptake by cabbage of disulfoton from the soil is slightly different to that of phorate.

The control of mites on chrysanthemums by means of aldicarb also depends on the concentration of the preparation in the leaves. In a combined trial undertaken with the Horticultural Research Institute, uptake and reduction were investigated.

Ultra-low volume spraying equipment, both intended for manual use and mounted on a light truck, was developed for locust control and evaluated experimentally. Next season this equipment will be tested in the field and, if it is satisfactory, will be produced on a large scale.

Some 60 new remedies and 400 amendments to the existing registration of insecticides, fungicides and rodenticides have been reviewed and recommended for registration under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, No. 36 of 1947.

The annual Department communication, *A Guide to the Use of Pesticides and Fungicides in South Africa* (132 pages), was updated and appeared in August 1976. The further updated Afrikaans version, *'n Handleiding vir die gebruik van Plaagdoders en Swamdoders in Suid-Afrika* (212 pages), appeared in February 1977.

Rodents

Efficacy studies with anticoagulants for use against *Tatera brantsii* were continued in the laboratory. Warfarin (0,025%) in combination with sulfaquinoxaline (an antibacterial agent 0,025%) did not produce notably better results than warfarin (0,025%).

The results of palatability trials indicate that although bait that had not been tampered with was preferred to poisoned baits, no significant preference was shown for either chlorfacinone (0,005%) or warfarin plus sulfaquinoxaline (0,025% + 0,025%).

Of all the anticoagulants tested in the laboratory, chlorfacinone was found to be the most effective. Evaluation trials under field conditions were started at the Nooitgedacht Research Station during the summer. Preliminary results indicate that chlorfacinone can provide effective control. On the other hand, zinc phosphide (2,0%), which was effective in the laboratory, produced unsatisfactory results. This may be ascribed to the fact that the period during which non-poisonous bait was put out was too short.

NATIONAL COLLECTION OF NEMATODES

The National Collection was expanded to 12 336 microscope slides, representing about 55 800 specimens. Taxonomic studies of the genera *Helicotylenchus*, *Rotylenchus*, *Tylenchorhynchus*, *Merlinius* and *Quinisulcius* were completed. One new species was described and three species reported from South Africa for the first time. A study of five genera of the Criconematidae revealed two new species.

During the year under review 1 600 routine soil and root samples were processed. Of this number 845 came from the Division of Plant and Seed Control and the rest from farmers and private and other Departmental bodies.

Nematodes in cotton

During the year under review four nematocides, namely carbofuran, Nemacur, Fumazone and ethylene bromide, were tested at Jan Kempdorp for the control of nematodes in cotton. The best results were obtained with ethylene bromide, although all the other preparations, and a planting of oats from the previous winter, produced better results than the control.

Nine cotton cultivars were tested for their resistance to *Meloidogyne incognita*.

A survey was carried out at the Loskop Dam Irrigation Scheme to determine which phytoparasitic nematodes occur there.

Potato cyst nematode

Experiments are being conducted on the economic importance and chemical control of this nematode. Control with the aid of existing potato cultivars is also being investigated, but no resistance has so far been found in any of the South African cultivars.

Nematodes in maize

An external nematode parasite, *Tylenchorhynchus goffarti*, has been found in very large numbers in poor stands of maize in the Western Transvaal. Control trials and other trials are planned.

Virus transmission by nematodes

Glasshouse experiments to establish and maintain pure cultures of various *Xiphinema* species are continuing. So far it has not been possible to transmit grapevine fanleaf virus with any of the present cultures.

Nematodes in vines

A field trial using nematocides on established Cinsaut on Jacquez vines has been terminated. The response of the plants to application of an emulsifiable concentrate formulation of DBCP was statistically significant in the second and third years after treatment. At 30 months after application all

plant parasitic nematodes, with the exception of *Xiphinema elongatum*, had recovered from the effect of the nematocide.

Exploratory moves have been made in a scheme to ascertain the genera of plant parasitic nematodes which might be present in certain deciduous fruit nurseries in the Western Cape.

The discovery that *Pratylenchus penetrans*, a root lesion nematode of many crops (including deciduous fruits) which is capable of heavily infesting potato tubers, is of considerable importance. Investigations into the significance of the discovery and the bionomics of this nematode are in progress.

NATIONAL COLLECTION OF ARACHNIDS

In all 670 identifications of 128 mite species were carried out. This included 33 phytoparasitic species. Mite accessions during the year under review amounted to 3 308.

During the year under review 194 specimens were collected from agricultural crops and wild plants.

Accessions of spiders amounted to 2 127.

PHYTOSANITARY SERVICES

During the past year 128 samples of imported plant material were examined microscopically for the presence of injurious organisms. Of these, 39 were found to be infested.

In the application of the Agricultural Pests Act, No. 3 of 1973, 240 samples of fruit tree cuttings were examined for the presence of scale insects, in particular pernicious scale *Quadraspidiotus perniciosus* and grey scale *Diaspidiotus africanus*.

Following laboratory examination, four consignments of export fruit were rejected by the Division of Plant and Seed Control. All were infested with pernicious scale.

Regular inspections of plants growing under quarantine conditions have been made and chemical control measures applied where necessary.

An investigation into the permanent recovery of vineyard soils infected with the soil-borne grapevine fanleaf virus and its nematode vector *Xiphinema index* using D-D soil fumigant was initiated. Preliminary results indicate a significant reduction in nematode population. The experiment is to be continued.

Extensive sampling for nematode species in the S.A. Plant Improvement Organisation (SAPO) plots revealed none of the virus-carrying nematode species. In addition, 46 samples from other sources were examined for the presence and identification of plant parasitic nematodes.

Red spider mite *Tetranychus cinnabarinus*, a serious crop pest in agriculture and horticulture, has become resistant to a wide range of spray chemicals in countries overseas and to a lesser extent in the Republic.

There is now a growing interest on the part of nurserymen in the use of polythene tunnels for the year-round production of vegetables and flowers. As this industry expands there will be an ever-increasing need to control the mite, hopefully by means of biological methods, since these would nullify the hazards of resistance as well as those affecting human health.

To this end, investigations are in progress on the possibility of using a locally occurring predacious mite, *Amblyseius (mesoseiulus) longipes*, to control red spider mite on crops grown under glass or polythene.

PLANNING AND DEVELOPMENT OF IRRIGATION SCHEMES

The Irrigation Planning Section of the Soil and Irrigation Research Institute dealt with two matters connected with irrigation planning. Since this undertaking is of necessity a multidisciplinary one, the Section co-operated closely during the year under review with institutes, regions and divisions, and with other departments.

Firstly, determinations of agricultural irrigation potential with a view to possible irrigation development were carried out in the following areas: Bushmans River (Paterson to Alexandria), Eerste River (Stellenbosch), Boberg River (French Hoek to Riebeeck West), Kaffir River (Southern Free State), Gourits River (south of the Langeberg), Malmanioog (Zeerust) and Waterkloof (Rustenburg).

In the course of these studies land was selected for irrigation development on the basis of an interpretation of the physical factors, (climate, soil type, site form, water quality and drainage) and a combination of these factors and production-economic qualities. The results were used for profit:cost analyses on the basis of which the viability of projects was judged. About 68 400 ha was classified as net potential irrigable land, with a theoretical irrigation advantage of about R23 million.

Secondly, work on the planning of the Vanderkloof Scheme continued throughout the year. The farm layout of the Bleskop areas was modified and improved, and road and drainage routes and expropriation limits were finalised. A preliminary farm layout plan was drawn up for the Baviaanskrans and Kalkplaat areas.

CHEMICAL SERVICES

In terms of Act 36 of 1947 963 samples were taken from stock feed factories, mills, fertiliser factories, limestone quarries and the premises of manufacturers of agricultural and stock remedies, and analysed.

During 1976, 2 667 541 metric tons of fertiliser was used for agricultural crops. This figure includes 319 101 tons of nitrogen, 163 585 tons of phosphorus and 111 207 tons of potassium. In

order to counteract soil acidity, 1 097 011 tons of calcitic and dolomitic agricultural lime and 21 645 tons of slaked lime were used.

The Analytical Chemistry Subsection of the Highveld Region analysed a total of 7 915 soil samples and 4 173 plant and feed samples during the year under review. This is an increase of 27% and 30%, respectively, in comparison with the previous year.

The analysis of soil samples from the preferential development areas of the Region was the biggest task of the Subsection. The number of samples from the areas constituted 63% of the total, an increase of about 66% over the figure for 1975/76.

The accompanying data show the number of analyses performed during the year under review:

Soil analyses	Samples	Determinations
Preferential development areas	5 019	92 731
Advice on fertilising (farmers)	2 157	23 727
Research sections	739	8 039
Plant analyses for research purposes	4 016	8 763
Plant and feed analyses for farmers	12	33
Feed analyses for research sections	145	771

There was an increase in the number of soil samples submitted for advice on fertilising.

Considerable progress has been made in the OFS Region with the standardisation of analytical methods and the prescribed techniques are already being widely applied. The bicarbonate extraction method is still used for phosphorus determinations because it has been found by a number of researchers, abroad as well as in this country, to be the most suitable method for the soil types that occur most generally in the Free State Region.

The routine soil analyses carried out in order to give advice on fertilising include a comprehensive analysis for brackishness as well as particle size, because brack problems are fairly severe in the Free State Region.

In order to ensure that the quality of the analytical service is maintained at a high level, the Region participates in the National Interlaboratory Soil and Plant Analysis Control Scheme. This scheme is controlled by the Soil and Irrigation Research Institute. Participants have the opportunity to compare analytical results with those of other laboratories.

The following numbers of samples were received during the year under review and analysed by the routine analysis section:

Soil samples	
For brackishness and other surveys	1 361
For research	490
For farmers, to advise on fertilising	1 785
Water samples	
For farmers, for advisory purposes	19
Samples of plant matter	
For research	1 989

Biological samples
For research

224

Total number of samples
Total number of determinations

5 868
53 998

The total number of soil samples submitted by farmers in the Eastern Cape Region this year, i.e. 974, was more than twice the total for the year 1974/75.

The top three magisterial districts, Bathurst, Humansdorp and East London, accounted for over 40% of the total number of samples received.

The figures available show that a large proportion of the samples submitted (577 out of 974) were low in phosphorus and that generally the samples submitted were well supplied with calcium and magnesium. Most of the very acid soil samples were submitted by farmers in the Humansdorp, Stutterheim and Elliot districts.

The increase in the number of samples handled by the *Cedara Laboratory* continued. There were a 46% increase in the number of soil samples and a 165% increase in plant/feed samples received from Natal farmers. In total, 46 031 analytical determinations were carried out.

Despite substantial increases in the price of chemicals and other operating supplies, the overall increase in the cost of analysis was kept to less than 4%.

THE ELECTRON MICROSCOPE UNIT

The scanning and transmission electron microscope facilities were put into service at the Plant Protection Research Institute during the past year.

Services were rendered to a large number of researchers at the Institute itself and at the Botanical Research Institute, the Tobacco Research Institute, the Transvaal Region and the CSIR.

The electron microscope facilities are already contributing a great deal to the expansion of research activities at the Institute and will play an increasingly important part in future.

COMPUTER CENTRE SERVICES

Computer facilities

The Computer Centre replaced its Burroughs B6700 computer with a Burroughs B7700 during the year under review. Sixty terminals throughout the country are linked to this computer. A map showing the situation of the Department's terminals is included.

Work load

The computer was used five days a week and 24 hours a day. In addition it worked for 16 hours per week-end. Expressed in monetary terms, the following use was made of the facilities of the Computer Centre:

Computer services	-	R1 645 877
Punching services	-	94 119
Programming services	-	Free
Total	-	R1 740 006

The actual expenditure of the Computer Centre for the year was R1 677 903.

Clients

A full computer service was supplied to the three departments of agriculture and the Department of Water Affairs. Computer processing was also undertaken in respect of the target budget and financial systems and on behalf of the following Departments:

Community Development, Health, Government Printing Works and Treasury

AGRICULTURAL ENGINEERING SERVICES

The basic aim of the Division of Agricultural Engineering is to provide the engineering expertise necessary for optimal utilisation of natural resources.

The work of the Division may be classified into seven groups:

- Agricultural mechanisation in plant production.
- Agricultural mechanisation in livestock farming, with emphasis on housing

- Processing, handling and storage of agricultural produce.
- Water utilisation in agriculture, with emphasis on irrigation engineering.
- Engineering in relation to the conservation of natural resources.
- Professional and technical services rendered to the Department of Agricultural Technical Services and other Government organisations.
- Advisory and educational services.

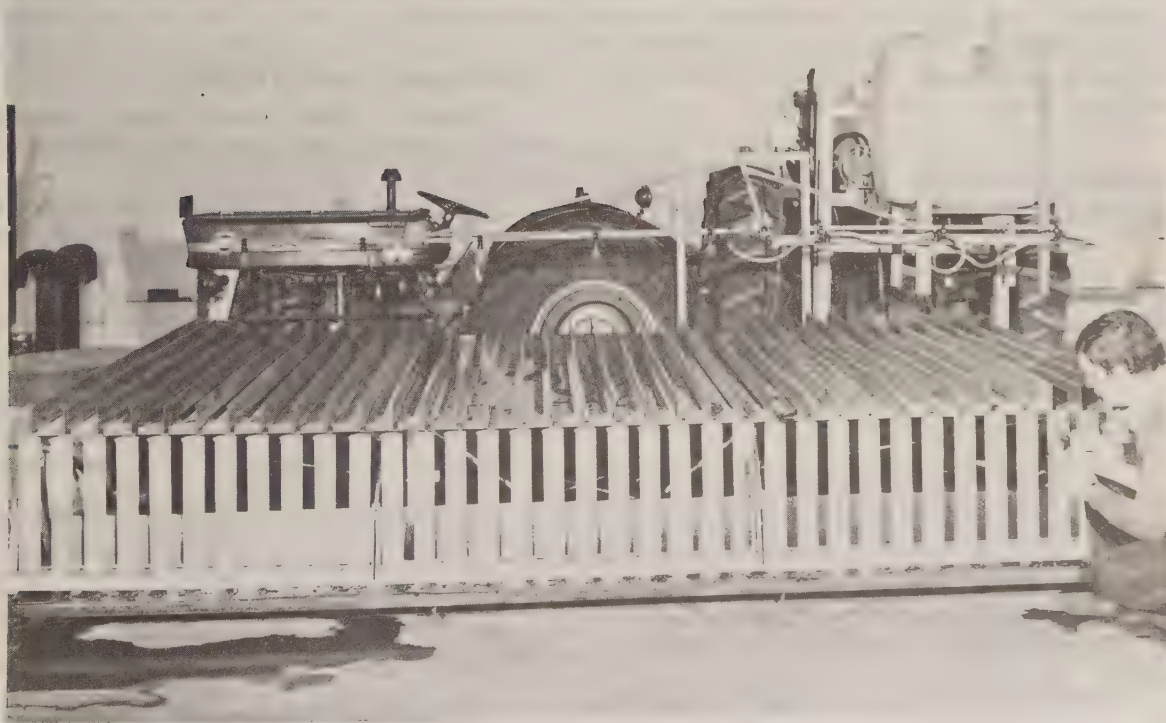
In carrying out the functions of the Division, the staff are engaged on about 200 assignments which can be divided into five categories:

- Testing - 30%
- Research - 25%
- Advisory Services - 20%
- Professional and technical services - 15%
- Development - 10%

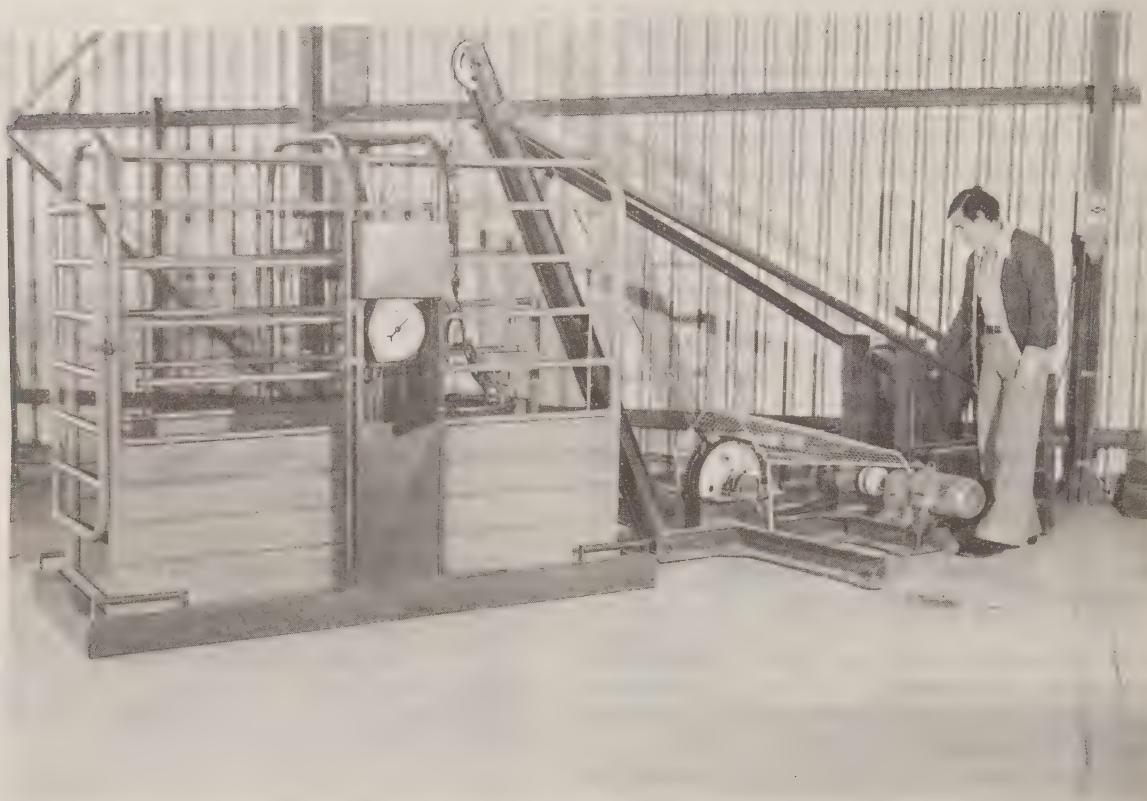
LIAISON WITH THE PRIVATE SECTOR

The Division maintains close contact with manufacturers and distributors and other organisations in the private sector which are concerned with agricultural engineering.

With this in mind, the Division prepared a carefully planned programme in 1972, to bring about close co-operation. Within the relatively short period of five years this objective has been accomplished, and the agricultural industry has benefited in various ways.



The apparatus developed by the Division of Agricultural Engineering to determine the distribution patterns of weed sprays at various heights



The Division of Agricultural Engineering is at present testing a second series of animal scales. The test reports on the first series made a large contribution towards the improvement of animal scales

Especially noteworthy is the excellent work done in this regard by the Tractor Liaison Committee, the Advisory Committee for the Testing of Agricultural Engineering equipment, the Horticultural Tractor Industry Organisation, and the South African Irrigation Institute.

AGRICULTURAL MECHANISATION : RESEARCH AND DEVELOPMENT

Apart from testing, a great deal of research and development has been undertaken in connection with mechanisation in agriculture. The more important projects are briefly reported on.

Mechanisation planning

Because mechanisation and labour represent an increasingly large proportion of the costs of arable farming, the Division has devoted much attention to an assessment of current mechanisation systems and labour utilization. From an analysis of the data collected a simple technique was developed for producing a co-ordinated farm mechanisation plan.

The technique has been presented in the form of two-day "workshop" courses attended by farmers, agricultural extension officers, dealers in agricultural machinery and officials from co-operatives.

Since the Division started these courses in 1975 about 50 have been attended by more than 1 200 people.

Tractor power and traction

Studies show that very substantial improvements can be made in the efficient use of tractors.

Factors which were studied were those which affect the traction of tractors in various working conditions, with ordinary single-drive wheels, dual wheels and four-wheel drive transmission.

Modern tractors are designed to operate at fairly high speeds, but in South Africa, tractors are commonly used at too low speeds. The growing interest in short courses and demonstrations dealing with efficient tractor use indicates that farmers are becoming more aware of the importance of optimum tractor performance.

A highly sophisticated power-testing laboratory, for the accurate measurement of various aspects of tractor performance, is to be built.

Grain drying

There is a growing demand for technical and professional guidance in connection with grain drying. In conjunction with the Maize Board and the co-operatives, trials continue on maize drying at low temperatures in large silos.

For some time farmers' drying installations have been evaluated and with the experience and knowledge gained important design criteria have been formulated.

Farmers have been given considerable technical assistance in planning their own drying installations, and short courses on this subject have been organised. A publication on standard designs for farm driers is being completed.

Ultra-low-volume spraying equipment for locust control

An investigation into the practicability of using ultra-low-volume spraying equipment in locust control resulted in the development of a machine which is mounted on a light delivery vehicle and which can be easily controlled by the driver. After repeated testing of the prototype, a robust and compact machine was developed, which meets all requirements.

The development of equipment for the treatment of low quality roughage with caustic soda

Experiments conducted at the Animal and Dairy Science Research Institute showed a 100% increase in the digestibility of certain roughages after treatment with caustic soda. Problems arose in the practical application of the principle and the Division of Agricultural Engineering was approached for assistance.

A device was required to provide a controlled application of the caustic soda to the roughage. It was necessary for it to be of simple and cheap construction so that it could be used on small farms, excluding grinding and mixing from the processing cycle.

The final design makes use of a continuous spray from a reciprocating boom, fed through a screening system by a positive displacement pump.

Saturation tests were carried out on the completed machine, using a very weak solution of caustic soda. It was found that a bale of maize stalks or wheat straw reached saturation point after about 70 minutes, absorbing up to two and a half times its own mass of liquid.

Dairy equipment

Following up the extensive tests conducted on milking machines during 1970/71, the Division has now evaluated a number of milking machine components. Firms often request the Division to test components before they import them on a large scale.

Testing of milk measuring and sampling equipment for use on bulk milk collection tankers

In the Republic payment for fresh milk is based on the quantity, fat content, protein content and bacteriological quality.

Owing to the inaccuracies which can arise as a result of existing measuring techniques, it is proposed to introduce flow meters and automatic sampling devices for use on bulk milk collection tankers.

The Milk Board approached the Department and the SABS to arrange for investigations to be carried out into the suitability of the various types of equipment currently being marketed overseas for these purposes.

It was subsequently agreed that the Animal and Dairy Science Research Institute at Irene and the Division of Agricultural Engineering should jointly carry out tests to establish the suitability of



done by the
of Agricultural
showed that
of mechanical
irrigation systems
that it would
profitable if used
the full time

such equipment for measuring quantity and for taking accurate samples.

The investigation was completed during the year and the required reports with recommendations submitted to the Milk Board.

Mechanical harvesting of grapes

In the past, tests were performed with machines obtained from firms, but during the year a Chrisholm-Ryder mechanical harvester was acquired by the Department. This will greatly facilitate future work on mechanical harvesting.

The following parameters were measured with this machine:

- Ground speed in m/h
- Harvesting rate in ha/h and t/h
- Beater velocity frequency and amplitude
- Ground and vine losses
- Bunches, whole and broken berries, leaves and other foreign matter, free juice and stalks in the harvested mass.
- Damage to vines and trellises.

Samples were taken for analysis and oenological evaluation.

A general outbreak of downy mildew, resulting in varying yields, severely hampered tests.

The following were, however, shown up clearly:

- The surface of the soil in the vineyard should be fairly even.
- Ridges in the row made mechanical harvesting impossible in one case.
- Ample turnstrips should be allowed for at the end of rows, or else a lot of time will be wasted when turning.
- The importance of a trellis and pruning system suited to the machine cannot be stressed too strongly.
- Previous tests showed, however, that when machine harvesting was employed in favourable conditions, especially on suitably adapted cultivars and where vineyards were appropriately trellised, the results were exceptionally good.

Winery equipment

A great deal of attention is given to the planning of wineries. Also, winery equipment is regularly tested and its performance evaluated. Recently, various characteristics of wine presses have been studied, of which the following are examples:

Studies were carried out to determine the mechanical characteristics of different thermo-vinification systems and to evaluate the wine produced by the systems. Three systems in three different cellars respectively were evaluated with Pinotage and Cinsaut grapes. Throughput, juice recovery and electricity and fuel consumption were measured for each system and running costs determined. Samples were taken for oenological evaluation. Results were indifferent, mainly because of the bad quality of available grapes as a result of downy mildew attack. Valuable experience of the different systems was, however, obtained.

Fruit dehydration tunnels

A model of a California type backflow dehydration tunnel was built to simulate the fluctuating drying conditions in a commercial tunnel. All the important parameters, such as air speed and dry- and wet-bulb temperatures, could be simulated accurately in the model and varied electronically. Analysis showed simulation to be reliable. Twelve tests on apple rings were then done and a method of analysing the results was developed.

A computer programme was written which used the results of this analysis to determine the effects of the following factors on the capacity and efficiency of the dehydrator: air speed in dehydrator; temperature and humidity of air; thickness of apple rings; and length of dehydrator.

The use of evaporative cooling for the cooling of table grapes

It was found that very little information about evaporative cooling was available. An apparatus was therefore designed and built to investigate the possibilities of evaporative cooling. Tests were carried out with different mat materials. Trials were made with different air speeds and spray angles.

It was found that spraying water into the air stream gave better results than when drawing air through a wet mat.

Tractor Liaison Committee

The Tractor Liaison Committee, on which are represented the importers and distributors of all 15 makes of tractors currently available in South Africa, meets quarterly to discuss matters of common interest.

The establishment of this committee makes possible consultation and co-operative action in regard to any important issues that may arise. The committee recently discussed a serious problem that arose in connection with tractor tyres. A subcommittee was appointed to discuss the situation with representatives of the tyre manufacturers, officials of the Departments of Commerce and of Industries and other interested parties, and an effective arrangement was soon worked out.

TESTING OF AGRICULTURAL MACHINERY AND EQUIPMENT

The official testing of agricultural machinery and equipment is one of the more important activities of the Division. Commercially available equipment is evaluated with regard to performance, durability and other characteristics.

The resultant reports are issued under the trade names of the products. Participation by manufacturers or dealers is voluntary, and the Division's services are given free of charge.

Three series of official test reports were published this year:

Semi-mounted mouldboard ploughs Nos. 7611 to 7614 (4 units)

Drippers for irrigation Nos. 7621 to 7624 (4 units)

Sprinklers for irrigation Nos. 7631 to 7652 (22 units)

Previously published test reports are:

	Nos.
Planters	7101 to 7107
Cattle scales	7201 to 7208
Fertiliser spreaders	7209 to 7214
Mouldboard ploughs	7215 to 7223
Milking machines	7301 to 7306
Hammer mills	7307 to 7318
Disc ploughs	7319 to 7321
Subsoilers	7322 to 7328
Disc harrows	7401 to 7410
Planters	7411 to 7414
Pick-up balers	7415 to 7420
Vineyard spraying machines	7421 to 7425
Vineyard spraying machines	7501 to 7506
Fans for drying agricultural produce	7507 to 7513
Tine implements	7514 to 7525
Mounted mowers	7531 to 7536
Granular herbicide applicators	7601 to 7604
Semi-mounted mouldboard ploughs	7611 to 7614
Drippers for irrigation	7621 to 7624
Sprinklers	7631 to 7652
Feed mixers	7661 to 7675

Test programmes at various stages of completion cover pumps, forage harvesters, orchard spraying machines, vineyard sprayers, animal scales, sprinklers, drippers, pelleting machines and hammer mills.

For the pump testing programme a special laboratory was constructed. There are about 500 types of pumps on the South African market, and it was decided to confine the first stage of the test to about 50 centrifugal pumps with 50 to 100 mm outlets, using no more than 30 kW. The preliminary findings indicate that these tests are supplying useful information with a view to accurate design.

FARM BUILDINGS: RESEARCH AND DEVELOPMENT

With the modernisation of farming in South Africa, there is an increasing need for expert planning and design of farm buildings and related structures and equipment. As livestock farming became intensified, the first aspects to receive attention were dairy establishments and pig housing, but lately the Division has also given attention to feedlots, sheep housing, tick control systems and to associated pollution problems.

Feedlots

The Division has planned several intensive farming systems for cattle and sheep and played a leading role in the development of feedlot complexes, taking into account such important design factors as slope, wind direction, pollution, the detrimental effect of excessive noise, waste

disposal, feed and water supply and the sorting of livestock.

Tick control installations

The investigation of spray race installations and other tick control systems continues. A great deal of highly significant information has already been obtained and is being collated for publication. One finding enabled the Division's engineers to reduce the size and cost of dipping tanks.

Calf housing

Information obtained in the course of investigations has been used to draw up practical plans and guides which have been of great value to farmers.

Ventilation and stock housing

The importance of good design of roofs and ventilation openings is often overlooked. The Division has drawn attention to the subject in a series of short courses and has constructed models to demonstrate to participants the basic principles of good ventilation, as well as the root causes of poor ventilation and how improvements may be made.

Dairy housing research project

The need being realised for research into the economical production and managerial aspects of the various intensive dairy housing systems found in South Africa, the Division is collaborating with interested organisations in the Departments of Agricultural Technical Services and of Agricultural Economics and Marketing in a research project on the systems in use, viz:

The open camp system with 50 m² per animal and portable feeding troughs.

The deep litter system with 6 to 8 m² per animal, an enclosed environment with feeding troughs on the sides.

The cubicle system with 6 to 8 m² per animal, an enclosed environment with feeding troughs on the sides.

Each system will be for 50 cows in production and each system will be considered individually to investigate its suitability from the point of view of economical production and management.

Gas light silage and haylage structures

The Land Bank was recently approached by certain firms with requests that farmers be granted financial aid to enable them to purchase their own fodder storage structures. The firms claimed that their structures offered better management and better fodder quality.

The Land Bank then approached the Division to investigate gas light silage stores with regard to:

- Ease of management
- Degree to which the system can be mechanised

- Durability
- Quality of the feed produced in such structures versus the quality of the fodder from conventional silage structures
- An economical, long-term comparison between conventional and gas light structures.

In co-operation with scientists in the fields of animal feeding, agronomy and agricultural economics, a detailed investigation was made and a report drawn up for presentation to the Land Bank.

Dip testing unit for the SABS

On request, the Division planned and designed a unit for the testing of dipping agents, submitted for registration, prior to use in the Republic.

The unit has been erected and comprises facilities for the handling and sorting of test animals; interconnecting crush races including a cattle scale and operation table to facilitate weight recording and the making of tick counts; a dipping race comprising four in-line neck clamps where four test animals can be sprayed simultaneously with the dipping agent under test; and facilities for the collection and disposal of run-off dipping agent.

Quarantine facilities

The Animal and Dairy Science Research Institute became involved in the purchase of cattle and sheep for export to the homelands. Since there were no quarantine facilities available, the Division was requested to submit the necessary plans, which were duly completed and handed over to the authorities concerned.

PROFESSIONAL AND TECHNICAL SERVICES

The professional and technical services rendered by the staff of the Division to various departments and other Government bodies cover virtually all the engineering aspects of agricultural mechanisation, instrumentation, buildings and structures, soil and water utilisation and instructional courses offered at colleges of agriculture.

A summary of some of the most important tasks performed will give an indication of the nature and scope of this service, which is expanding every year.

Bulk storage of grain

In 1965 the Government launched a scheme for the erection of grain silos to encourage the bulk handling of grain.

The Division acts as technical adviser to the Grain Silo Committee and the Land Bank in terms of the loan scheme for the erection of bulk storage installations. Two engineers are working full time on this project. Their work entails the appraisal of new plans and submissions in respect of serviceability, cost and method of execution and

the certification of demands by contractors for loan funds.

It is estimated that by 1985 the required storage capacity will be 22,5 million m³. The capacity of the completed and approved structures amounts to about 12,8 million m³ (57%).

Irrigation, drainage and stock watering

Details (Highveld Region)	Survey	Design	Instal or Erect	Value (R)
Sprinkler irrigation system for Bethlehem Research Station		✓	✓	45 000
Sprinkler irrigation system for Div. of Agronomy, Potchefstroom		✓	✓	18 000
Mist irrigation system for Div. of Plant Pathology, Potchefstroom		✓	✓	12 000
Sprinkler irrigation system for Div. of Pastures		✓		25 000
Drainage system for Div. of Plant Pathology		✓		
Stock watering system for Div. of Animal Husbandry, Potchefstroom	✓	✓		10 000
Stock watering system for Div. of Animal Husbandry, Noyons	✓	✓		

Operational field - OFS Region

The field of operation of the office of the Regional Engineer was extended as from 1 March 1977 to include all engineering aspects of irrigation farming in the central regions. The three central regions are the OFS, Karoo and Eastern Cape Region, which include the following well-known irrigation areas:

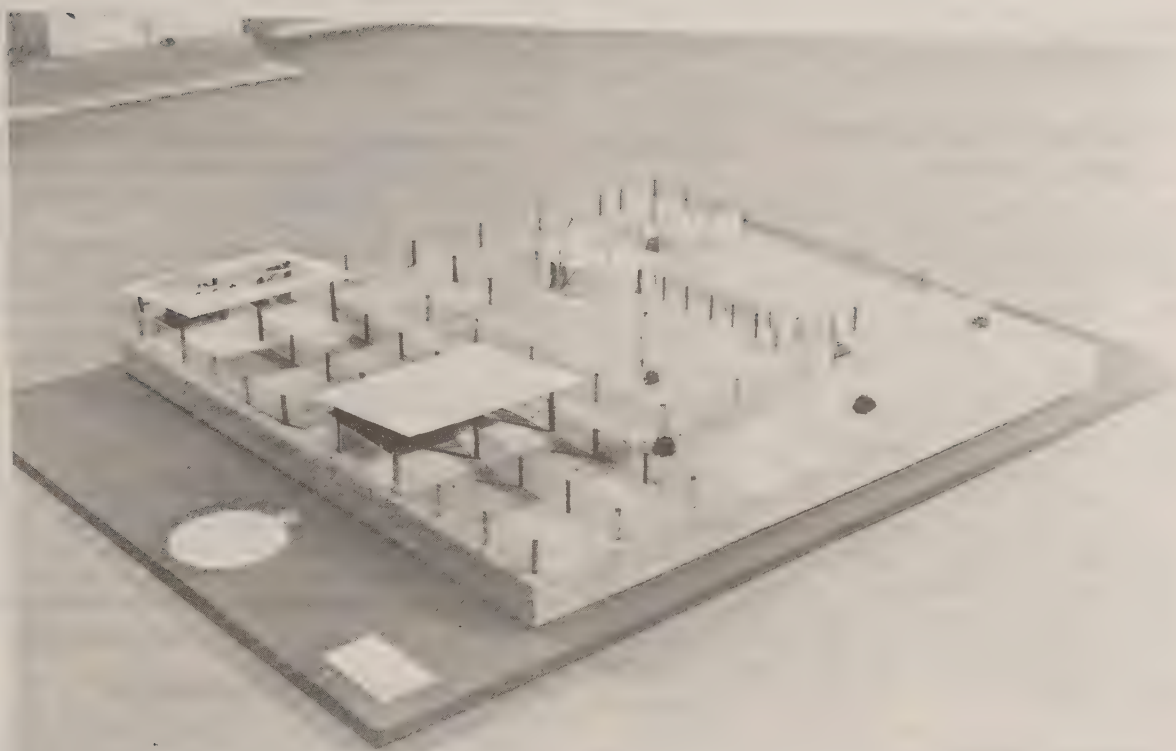
OFS Region - Vaalharts, Sand-Vet and Rie River Irrigation Schemes, Barkly West - Douglas area along the Vaal River, the Lower Orange River, and new and proposed schemes below the new P.K. le Roux Dam.

Karoo Region - Upper, central and lower Fish River areas which will be irrigated with water from the Hendrik Verwoerd Dam.

Eastern Cape Region - Sundays River Scheme which will also receive water from the Hendrik Verwoerd Dam.

SOIL CONSERVATION AND AGRICULTURAL RESOURCE PROTECTION

The Division of Agricultural Engineering plays a leading role in the soil conservation activities of the Department of Agricultural Technical Services, mainly with regard to the following:



One of the series of models on animal housing that is put to good use for training, information and extension purposes

- Run-off control planning, in co-operation with the regional staff concerned;
- the construction of major soil conservation works in badly eroded and vulnerable areas;
- soil conservation research and development; and
- professional guidance on soil conservation engineering to the Division of Soil Protection and to regional staff entrusted with the design of soil conservation works.

A few of the more important activities are discussed in some detail below.

Soil conservation research

Research and development on soil conservation are undertaken by a research team at Aliwal North and by several engineers in co-operation with members of the regional staff concerned.

The following are important achievements:

Soil conservation research team at Aliwal North

This team is working on several registered research projects and a number of pilot projects. The work is aimed mainly at developing simple and cheap, but effective, measures and structures for the reclamation and conservation of badly eroded and vulnerable areas.

Most of the trial sites are situated in real problem areas, where reclamation and conservation are generally extremely difficult, expensive and often uneconomic.

Noteworthy findings have been made. (See report on Soil Conservation Research, Chapter IV.)

Research in regions

Some of the staff of the Division are co-operating closely with regional staff in conservation research projects. The most important are briefly summarised below.

Natal Region

A multi-disciplinary international team including an engineer of the Division devised a model to predict soil loss. A publication has been compiled describing the model and its structure, operation and limitations.

A conservation team from the Natal Region has been allocated the task of refining the model, the aims being:

- To collect input data concerning all aspects of soil loss estimation.
- To compare predicted figures with actual experiments.
- To hold regular meetings to exchange information regularly.
- To establish priorities for erosion control research.

- To recommend programmes for widespread application of SLEMSA (Soil Loss Estimator for Southern Africa).

WATER UTILISATION IN AGRICULTURE

The activities of the Division with regard to water utilisation centred on irrigation and drainage and covered the following matters:

- Research and development, principally on equipment and techniques for irrigation : sprinkler, drip and flood
- Testing of equipment for irrigation
- Planning and design of irrigation systems
- Advisory service and training
- Professional auxiliary services.

Research and development were aimed at acquiring specialised engineering knowledge of all the most important aspects of irrigation, and applying that knowledge for the benefit of the agricultural industry, the main object being to ensure optimum use of our limited water resources.

The following were the most important matters studied:

Flood irrigation

Flood irrigation studies were undertaken in various existing irrigation schemes. The object was to determine the efficiency of the irrigation lay-outs and practices. It was found that in most cases improvements could be achieved without drastic changes to the existing lay-outs. By increasing the irrigation flow or reducing the bed width, a considerable reduction in supply was obtained without sacrificing distribution efficiency or the moisture requirements of the crop (wine grapes). Water savings in the region of 50 per cent were common.

Expropriated irrigation farms in the Fish River Valley were consolidated and allocated to farmers. These farms had been out of production for a considerable period, and the irrigation systems had to be replanned by officials of the Department. To get an idea of existing irrigation methods, application depths, uniformity of application, infiltration rates, stream size and cut-off times used, different farms in the valley were visited to evaluate their flood irrigation practices.

There proved to be such a wide variation in soils, stream sizes, bed lengths, widths and slopes that no general pattern could be observed. Because of the differing soil types and infiltration rates found, the design of irrigation beds in the Fish River Valley is a fairly complex and time-consuming exercise.

Mechanised sprinkler irrigation systems

Several types of mechanised sprinkler irrigation systems such as centre pivot, rotating boom, travelling big gun, side roll and variations of

these irrigation systems have recently become available in South Africa. These systems cost considerably more than conventional systems and may also work at much higher pressures than conventional systems.

Extensive field surveys were undertaken to evaluate these systems on farms and to get to know the systems intimately so as to evaluate their advantages and disadvantages. The findings indicate that the systems work efficiently, but that they are economically justifiable only if they are fully utilised, that is, for more than one crop a year.

Economical pipe size and material for sprinkler irrigation

A survey was done to determine the cost of different pipes available locally that can be used for main lines for sprinkler irrigation systems. A computer programme was written to determine the optimum pipe type and size for pipes with constant flow.

Hydro-electric power generation

The interest in the relatively cheap method of power generation developed by the Division, where a centrifugal pump is coupled in reverse and used as a turbine, is increasing.

An electrical governor was developed which will make construction and use by the farmer considerably easier.

Water purification on the farm

The Department of Health had problems with the quality of irrigation canal water that farm workers used for drinking water. The Division was approached for assistance in designing water purification systems that could be used on farms.

In collaboration with different organisations such as the CSIR, the Defence Force and private firms, an extensive investigation was conducted and a report with recommendations is being compiled for the authorities concerned.

Study of the water consumption of a dryland vine

Evapotranspiration measurements by means of continuous registering of the mass of a 1,5 x 3,0 x 1,6 m³ soil monolith in which a vine is growing were carried out. The general course of evapotranspiration could be determined, but it was not yet possible to relate this to meteorological factors.

Concise design procedures for irrigation pipelines with a series of outlets on specific slopes

A series of coaxial graphs was developed, by means of which calculations of pipe diameters, for instance, can be done graphically. A computer

programme for use with pocket computers with magnetic-strip programming has been developed. This will enable calculations for the design to be carried out precisely and conveniently.

Drainage

Evaluation of the suitability of modern drainage theory in the design of subsurface drainage systems in the Winter Rainfall Region

Apparatus was developed and constructed by means of which the water level in a series of piezometers can be lifted by means of a constant vacuum. A number of piezometers were installed at an existing tube drain on the experimental plot of the Oenological and Viticultural Research Institute at Lutzville, in order to determine the equipotential lines of the flow net. It was found that considerable variations in permeability occurred over short distances. It is doubtful whether the conventional drainage theory can be applied in this case.

Evaluation of filters and envelopes for drainage tubes

Tests were done with a porous type of drainage tube with a topsoil envelope. The entrance resistance of the pipe was found to be low, and an envelope is not essential in order to improve flow into the pipe.

A start was made on the development of a simple permeameter whereby the permeability of samples can be determined quickly and continuously.

The Division's staff stationed at Glen are responsible for technical control on all internal subsurface drainage schemes submitted for subsidy under the Soil Conservation Act. Altogether more than 200 plans of drainage systems were submitted, involving a total subsidy of more than R1,5 million.

A start was made on a water table survey of approximately 5 000 ha in the Golden Valley area.

A Soil Conservation Act manual for use by field officers when handling applications for subsidy on underground drainage systems was prepared by the Division's engineers in the Orange Free State.

AGRICULTURAL ENGINEERING ADVISORY SERVICES AND EDUCATION

In conformity with the Division's policy, the different subdivisions are responsible for research as well as for advisory services. However, the demand for advisory services has increased to such a degree that a special subdivision, entitled Farming Development, was recently created to co-ordinate and promote the advisory services.

This Subdivision liaises very closely with all the Departmental and private organisations rendering extension and advisory services to farmers and other sectors of agriculture. A further

function is the promotion and co-ordination of agricultural engineering publications.

The following paragraphs indicate the nature and extent of this Subdivision's functions and duties:

Publications

Over the past four years the demand for test reports and leaflets on agricultural engineering subjects has increased from an average of 600 to more than 12 000 per month.

In addition to regular announcements over the radio programme Calling All Farmers, information on new titles is sent to the agricultural press and also distributed to interested persons whose names appear on a mailing list. Most enquiries about publications result from announcements over the agricultural radio programme.

With regard to the SABC radio programmes, the Division's weekly talk on current agricultural engineering features usually evokes widespread interest. The Division's diversified activities, e.g. short courses, demonstrations, papers delivered by the Director and senior staff, are regularly reported on in detail.

Several popular agricultural journals publish the Division's leaflets as articles, thus giving widespread publicity to the Division's activities.

Short courses, lectures and demonstrations

Numerous short courses, demonstrations and lectures are currently given, not only to groups of farmers but also to agricultural extension officers or persons whose work involves extension. The groups formed for training in some form or other include the following:

In co-operation with the Department of Water Affairs and the Soil and Irrigation Research Institute, the training of sales representatives of members of the Sprinkler Irrigation Association of South Africa (who also prepare the required system designs) was continued by means of four-week courses on irrigation. The ultimate aim is to train all these representatives, of whom there are about 450.

Several groups of sales representatives handling agricultural machines and implements have attended short courses dealing with mechanisation planning, tractor performance and tillage implements. Some firms have recently introduced similar courses for the in-service training of their sales and service personnel.

Groups of co-operative society members entrusted with extension and/or design duties have received training in the mechanical handling of groundnuts and grain, and were also given training in connection with drying equipment for these products.

The senior diploma students of the Potchefstroom College of Agriculture visit the

Division annually to acquaint themselves with the Division's activities.

Several groups of learner technicians of the Department who are engaged in formal training annually attend approximately 20 lectures or demonstrations on agricultural mechanisation and other engineering subjects at the Division in Silverton.

A few groups of Black teachers and scholars visited the Division during the year.

"Jiffy courses"

A series of one-day courses has been started at the Division. The idea is for specialists in various fields to present one-day courses monthly, in order to bring farmers and other interested people into contact with the specialists concerned and to create a channel for disseminating information. During the past year courses have been held on the following topics:

Mechanisation planning	Pig housing
Tractor performance	Dips and cattle scales
Soil tillage implements	Processing of fodder
Milking machines	Greenhouses
Dairy farm facilities	Handling animal wastes
Hammer mills	Planters
Feed mixers	Handling and drying of grain
Irrigation scheduling	Groundnut mechanisation
Sprinkler irrigation	Sheep raising

Each course was repeated from four to eight times.

Advisory services to individuals

Advisory services to individuals are generally rendered by the Division's officers stationed in the regions. However an estimated 1 200 to 1 500 individuals with pressing problems which they wanted to discuss with experts visited the Division's offices at Silverton during the year.

Diploma students

As the demand grows for engineering knowledge in agriculture, the teaching of agricultural engineering subjects to diploma students at colleges of agriculture becomes increasingly important. During the year considerable progress was made in the compiling of uniform basic lectures on all the agricultural engineering subjects. It is estimated that these lectures will be ready for printing during the ensuing year.

Food Expo 1976

The Division's participation in Food EXPO 1976 in May was geared to extension. This was emphasised by the first exhibition of its kind, a large-scale display of the 18 series of implements and equipment for which test results had already been published (in all, over 200 units). The officers who carried out the tests were available to provide, from first-hand knowledge, any additional information required by visitors.

One of the Division's exhibits which attracted lively interest was that dealing with animal housing. It included small-scale examples of different dairy lay-outs. Also on display were several models which very effectively demonstrated the importance of good ventilation and methods of achieving it.

In operation on the irrigation stand was the actual equipment used for some of the sprinkler tests. Many visitors asked for detailed information on a working exhibit which demonstrated how an ordinary centrifugal pump could be used to generate electricity, operating as a turbine.

An "action" stand on which tractor performance was demonstrated was a highlight for the mechanically minded visitor. The response of a tractor to varying loads was instantly visible on a screen.

ADMINISTRATIVE MATTERS

THE ESTABLISHMENT

POSTS

An indication is given in the table (POSTS) on the next page of the posts in the Department (in the respective Divisions into which the posts are divided in the Public Service) as at 30 June 1977, as well as of the number of vacancies in each Division, compared with the corresponding period for the previous year.

IMPORTANT ORGANISATIONAL AND ESTABLISHMENT CHANGES

1. The Division of Agricultural Engineering was re-organised on 1 September 1976 in order to adapt to changes in the services required from the Division.
2. An Entomology Section was introduced at the Oenological and Viticultural Research Institute on 1 October 1976.
3. Additional administrative posts were created for the Veterinary, Plant Protection and Citrus and Subtropical Fruit Research Institutes as from 1 April 1977.

4. The Grain Technology and Analyses Section of the Winter Rainfall Region was replaced by an Analyses Section on 1 May 1977 in order to provide a central analytical service.
5. Upon the creation of the KwaZulu Homeland the State Veterinary Office at Eshowe was closed, on 1 May 1977, and the White service area was incorporated into neighbouring State veterinary areas.
6. The establishment of the Division of Veterinary Services was expanded to make it possible to provide meat hygiene services in terms of the Animal Slaughter, Meat and Animal Products Hygiene Act at the Port Elizabeth, East London and Bloemfontein abattoirs.

POSTS

Division	Authorised posts	1976-06-30		Authorised posts	1977-06-30	
		Vacant posts Number	%		Vacant posts Number	%
Administrative	163	9	5,5	172	16	9,3
Clerical	494	51	10,3	511	40	7,8
Professional	1 501	236	15,7	1 459	246	16,9
Technical	1 609	197	12,2	1 660	237	14,3
General A	84	10	11,9	81	6	7,4
General B	2 220	330	14,9	2 217	291	13,1
Non-classified	150	28	18,7	187	60	32,1
Posts additional to the approved establishment	106	82	77,3	88	36	40,9
Total	6 327	943	14,9	6 375	932	14,6

Increase/decrease in the number of authorised posts in the various classes over the past five years:

Division	1973-06-30	1974-06-30	1975-06-30	1976-06-30	1977-06-30	Total % increase or decrease
Administrative	145	155	164	163	172	+ 18,6
Clerical	475	478	481	494	511	+ 7,6
Professional	1 691	1 583	1 494	1 501	1 459	- 13,7
Technical	1 544	1 566	1 586	1 609	1 660	+ 7,5
General A	86	86	85	84	81	- 5,8
General B	2 221	2 324	2 216	2 220	2 217	- 0,2
Non-classified	286	174	171	150	187	- 34,6
Total	6 448	6 366	6 197	6 221	6 287	- 2,5

Note: Non-classified posts do not include posts additional to the establishment

STAFF GAINS AND LOSSES

Division	1975-07-01 to 1976-06-30			1976-07-01 to 1977-06-30		
	*Gains	**Losses	%	*Gains	**Losses	%
Administrative	16	16	-	18	16	+ 11,1
Clerical	187	167	+ 10,7	172	128	+ 25,6
Professional	144	191	- 32,6	142	152	- 7,0
Technical	259	311	- 20,1	228	193	+ 15,3
General A	12	12	-	25	18	+ 28,0
General B	738	773	- 4,7	677	610	+ 9,9
Non-classified	70	92	- 31,4	59	72	- 22,0
Total	1 426	1 562	- 9,5	1 321	1 189	+ 10,0

*By "gains" is meant all persons gained by every Division, i.e. appointments from outside, promotions and translations from one Division to another, and transfers from other Departments

**By "Losses" is meant all persons lost by various Divisions (individually or jointly), including translations and promotions to other Divisions and cases where persons left the service for good, such as resignations, deaths, retirements, abscondences and dismissals

STAFF CHANGES (SENIOR STAFF)

RETIREMENTS

The following senior officers retired from the service of the Department after a long career, on reaching the age limit:

Name	Rank	Institution to which attached	Years of service	Date of leaving service
Dr P.R. Mansvelt	Director	Division of Veterinary Services	37	1976-09-30

Name	Rank	Institution to which attached	Years of service	Date of leaving service
Dr L.J.F. von Maltitz	Assistant Director	Division of Veterinary Services	38	1976-09-30
Mr J.C.D. Retief	Assistant Director	Division of Agricultural Information	30	1976-08-31
Mr P.L. Joubert	Assistant Chief	Head Office: Administration Branch	41	1976-09-30
	Accountant			
Mr R.W. Colenbrander	Deputy Secretary	Head Office: Administration Branch	42	1976-09-30
Mr J.E. Carstens	Under Secretary	Head Office: Administration Branch	37	1976-09-30
Mr V.M. Stewart	Under Secretary	Head Office: Administration Branch	39	1976-08-31

DEATHS

The Department learned with regret of the death of Mr A.J. Schoonwinkel, Deputy Secretary (Staff and Training), on 21 June 1977. Mr Schoonwinkel was a well-known figure in staff circles in the Public Service and served on several committees. His passing is a severe loss to the Department.

PROMOTIONS

Name	Rank to which promoted	Institution	Date of promotion
Dr J.P. van der Merwe	Director	Division of Veterinary Services	1976-10-01
Mr B.J. Dreyer	Deputy Secretary	Head Office: Administration Branch	1976-10-01
Mr J.D. Basson	Deputy Director	Highveld Region: Small Grain Research Centre at Bethlehem	1976-07-01
Dr C.N. MacVicar	Deputy Director	Soil and Irrigation Research Institute	1976-11-01
Dr W.M.H. Löwe	Assistant Director	Division of Veterinary Services	1976-09-01
Dr E.M. van Tonder	Assistant Director	Division of Veterinary Services	1976-09-01
Dr C.J. Coetzee	Assistant Director	Division of Veterinary Services	1976-10-01
Dr L.A.P. Anderson	Assistant Director	Veterinary Research Institute	1976-03-01
Dr A.E. Gillespie	Assistant Director	Division of Veterinary Services	1976-04-01
Mr H.W.P.W. Struck	Assistant Chief Engineer	Division of Agricultural Engineering	1976-10-01
Mr J.H. Eckard	Assistant Chief Engineer	Division of Agricultural Engineering	1976-10-01
Mr C.J. van Schalkwyk	Assistant Chief Engineer	Division of Agricultural Engineering	1976-10-01
Mr J.F. van Staden	Assistant Chief Engineer	Division of Agricultural Engineering	1976-11-01
Dr N.J. Robbertse	Assistant Director	Head Office: Professional Auxilliary Services Panel	1976-11-01
Dr J.J. Coetzee	Assistant Director	Highveld Region	1976-12-01
Dr A.L. du Pisani	Assistant Director	Soil and Irrigation Research Institute	1977-01-01
Mr B.S. Steenkamp	Principal Engineer	Division of Agricultural Engineering	1977-01-01
Mr J. Fuls	Principal Engineer	Division of Agricultural Engineering	1977-01-01
Dr J.E. Nel	Attaché (Agricultural Science)	Washington	1977-01-01
Mr P.J. van Rooyen	Special Soil Control Technician	Veterinary Research Institute	1976-09-01
Mr J.A. van Niekerk	Assistant Director (Administrative)	Transvaal Region	1976-09-01
Mr F. Huisman	Assistant Director (Administrative)	Division of Veterinary Services	1976-10-01
Mr K.P. Naudé	Assistant Director (Administrative)	Veterinary Research Institute	1977-04-01
Mr G.M. Botha	Under Secretary	Head Office: Foreign Matters	1976-10-01

TRAINING AND STAFF DEVELOPMENT

BURSARY SCHEME

The Department administers a bursary scheme for under-graduate study at local universities with funds donated by the various control boards. The following table shows the number of bursaries awarded since 1975 and their monetary value:

	Number of bursaries		Studies completed	Total monetary value of new grants
	New grants	Total		
Grants up to 1975	45	192	28	R118 000
Grants up to 1976	38	202	34	R 98 000
Grants up to 1977	46	214	31	R137 500

No bursaries were awarded during 1977 for post-graduate study in agricultural sciences at local universities.

IN-SERVICE TRAINING

In order to promote efficiency, staff serving on the establishment of the Department underwent the following training:

		Number of officers involved
(i)	<i>Administrative courses:</i>	
	Induction	120
	Supervision	150
(ii)	<i>Functional courses:</i>	
	Target budgeting	68
	O and M technique of provisioning	25
	Fruit cultivation	9
	Soil classification	24
	Sheep farming practice	19
	Veterinary science	21
	Farm planning	10
	Dairying	10
	Field husbandry	150
	Grazing	52
	Irrigation	30
(iii)	Overseas study (advanced scientific training)	9
(iv)	Overseas trips. See Annexure VII	

FORMAL TRAINING

Officers in the Department are afforded ample opportunity to improve their academic qualifications at Government expense, for purposes of appointment, promotion and also self-development, as is evident from the following:

(i)	<i>Diploma training:</i> Technicians and meat inspectors	
	Undergoing training	70
	Training completed	77
(ii)	<i>Formal in-service training:</i> Meat examiners	
	Undergoing training	18
	Training completed	7
(iii)	<i>Post-graduate study</i> (Local universities)	
	Professional staff	
	Exempted for study	
	(1977):	
	B.Agric.(Hons.)	9
	(Inst./ Agrar.)	
	B.Sc.(Agric.)(Hons.)	17
	Studies completed	
	(1976):	
	B.Agric.(Hons.)	4
	(Inst./ Agrar.)	
	B.Sc.(Agric.)(Hons.)	8
	Master's degree	1
(iv)	<i>Diploma training</i> (Optional)	
	Public administration, State accounts and finance, cost accountants	22
(v)	<i>Part-time study at a management level</i>	
	Advanced Diploma in Public Administration	1
	Master's degree in Public Administration	3

VII. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE

(Agricultural Building, Beatrix Street/Private Bag
X116, Pretoria)

Management

Dr W.A. Verbeek: Secretary

Directorate of Agricultural Technical Services

Dr D.W. Immelman: Chief Director (Chairman)

Dr J.C. Strydom: Chief Director (Horticulture)

Prof. S.A. Hulme: Chief Director (Crops and
Pastures)

Dr D.J. Agenbach: Chief Director (Agricultural
Resource and Farming Development)

Dr B.C. Jansen: Chief Director (Animal
Production)

Administrative Branch

Mr B.W. Viljoen: Senior Deputy Secretary

Personnel and Training

Mr J.C. Visser: Deputy Secretary (1977-11-01)

Mr P.M.A. Spreeth: Under Secretary (Personnel
Administration)

Auxiliary Services

Mr L.J. Botha: Deputy Secretary

Mr G.J. Smit: Under Secretary (Data Processing)

Mr M.D. Meyer: Under Secretary (Sundry
Services)

Mr G.P. Kleinhans: Chief Work Study Officer

Technical and Legal Affairs

Mr B.J. Dreyer: Deputy Secretary

Mr A.C. Bosch: Under Secretary (Technical
Administration)

Mr C.J. Wessels: Under Secretary (Statutory
Control) (w.c.f. 1977-12-01)

Mr C.S. de Villiers: Under Secretary (Legislation
and Parliamentary)

Mr G.M. Botha: Under Secretary (Foreign Affairs)

Finance

Mr P.B. de Klerk: Chief Accountant

Mr J.J. Lombard: Assistant Chief Accountant

Objective Budgeting

Mr H.F. van Zyl: Under Secretary

Departmental Inspectorate

Mr H.J. Kriek: Inspector

(b) SUBDIRECTORATE

Dr A.D. Nieuwoudt: Director (Co-ordination of
Irrigation)

Dr J.J. du Toit: Deputy Director (Co-ordination of
Agricultural Research)

Mr R.W. Nott: Deputy Director (Co-ordination of
Agricultural Resource Development)

Mr A.B. Bridgens: Deputy Director
(Secretary-General, SARCCUS)

Dr J.P. Jooste: Deputy Director (Biometry
Services)

Dr N.J. Robbertse: Assistant Director (Training)

Crops and Pastures Institute

Prof. A.J. Pienaar: Director

Mr T.E. Skinner: Deputy Director

Dr J.W. Snyman: Assistant Director

The Institute does not itself engage in research but gives guidance to research workers engaged in research in the different regions on summer grain, winter grain, other agricultural crops, pastures and pasture crops, and co-ordinates all research in this connection. The co-ordination of weed and poisonous plant research at the national level, as well as supplying technical information in connection with weedicides, is also a function of the Institute.

(c) FOREIGN REPRESENTATIVES

Paris (South African Embassy, 59 Quai d'Orsay,
75007 Paris, France)

Dr J.G. Boyazoglu: First Counsellor (Agricultural
Technical)

Mr J.A. Thomas: Counsellor (Agricultural
Technical)

Mr J.U. Rietman: Attaché (Agricultural Technical)

London (South African Embassy, Trafalgar
Square, London WC2N 5DP, England)

Mr C.S. Hawkins: Counsellor (Agricultural
Technical)

Washington (South African Embassy, 3051
Massachusetts Avenue NW, Washington DC
20008, USA)

Dr A.D. Venter: Counsellor (Agricultural Scientific)
 Dr J.E. Nel: Attaché (Agricultural Scientific)
Canberra (South African Embassy, Rhodes Place, Yarralumla, Canberra A.C.T. 2600, Australia)
 Mr J.H. l'Ons: Counsellor (Agricultural Technical) (1978-01-01)

(d) SPECIALISED RESEARCH INSTITUTES

Soil and Irrigation Research Institute Belvedere Street, Private Bag X79, Pretoria

Dr M.C. du Plessis: Director
 Dr P.F. Fuls: Deputy Director
 Dr C.N. MacVicar: Deputy Director
 Dr C.E.G. Schutte: Assistant Director (Chemical Analyses)
 Mr J.F. Eloff: Assistant Director (Soil Survey) (1977-08-01)
 Dr E. Verster: Assistant Director (Irrigation Planning)
 Dr A.L. du Pisani: Assistant Director (Agricultural Meteorology)
 Dr G.C. Green: Assistant Director (Irrigation Research)

The Institute is responsible for the classification of the soil and climatic resources of the Republic and also basic research with regard to the physical and chemical characteristics of soils on a national level. Soil surveys for irrigation projects and investigations into physical soil characteristics are also undertaken - particularly where brack and waterlogging conditions occur. In addition, the Institute undertakes chemical soil, water and plant material analyses, not only for this Department but for other State Departments, provincial administrations and other bodies. The Institute is also responsible for the inspection and analysis of fertilisers, stock feeds, stock remedies and agricultural remedies in terms of Act 36 of 1947. It is also responsible for basic irrigation research, and the agricultural evaluation and planning of irrigation areas. All agricultural meteorological research and data collection also falls under this Institute.

Plant Protection Research Institute Agricultural Building, Beatrix Street, Private Bag X134, Pretoria

Dr I.H. Wiese: Director
 Dr D.P. Annecke: Deputy Director
 Mr I.G. Venter: Assistant Director (Locust Control)
 Mr H.P. van Heerden: Assistant Director (Phytosanitary Services)
 Dr B.W. Strydom: Assistant Director (Plant Pathology/Microbiology)
 Mr D.J. Engelbrecht: Assistant Director (Virus Research)

The Institute is broadly responsible for advanced research and research at the national level on plant pathology, insect and animal pests and

their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagating material from viruses, honey-bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests and weeds. The Institute is also responsible for the examination and control of imported plant material and the control of migratory locusts. The Institute uses the research stations and experimental farms at Rietondale (Pretoria), Buffelspoort (Marikana), Fleurbaix and the quarantine station (Stellenbosch), as well as the research units for the control of prickly pear and jointed cactus at Uitenhage and forest pests at Rosebank (Cape Town).

Botanical Research Institute Private Bag X101, Pretoria

Dr B. de Winter: Director
 Dr D.J.B. Killick: Deputy Director
 Dr D. Edwards: Assistant Director

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanical Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute Private Bag X11208, Nelspruit

Dr J.H. Grobler: Director
 Mr A. van Oostrum: Deputy Director
 Dr D.L. Milne: Assistant Director

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs. The Institute also undertakes research at the research stations and experimental farms Addo (Eastern Cape), Burgershall, Citrusdal, East London, Friedenheim, Levubu (Louis Trichardt) Messina and Rustenburg.

Horticultural Research Institute Private Bag X293, Pretoria

Mr E. Strydom: Director
 Dr J.T. Meynhardt: Deputy Director
 Mr O.J. Olivier: Assistant Director

The Institute is responsible for all applied and fundamental research and extension on vegetables, cut-flowers, ornamental plants and shrubs throughout South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The Institute controls research stations for vegetables, flowers, decorative plants, table grapes and deciduous fruit research at Roodeplaat in the Transvaal Middleveld and for cherry and deciduous fruit

at Emperani, near Ficksburg. In addition the Institute undertakes research on vegetables in the winter rainfall area at Elsenburg, Outeniqua and Lutzville, as well as at Glen in the Orange Free State, at Nelspruit in the Transvaal Lowveld, at Cedara in Natal and at Addo in the Eastern Cape. Research on indigenous flowers, mainly proteas, is undertaken at Elsenburg and at the Tygerhoek Research Station near Riviersonderend.

Tobacco Research Institute

Kroondal, Private Bag, Rustenburg

Mr J.F. Peens: Director

Dr D.J. Rossouw: Deputy Director

Dr. M.P. Lamprecht: Assistant Director

The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research stations and experimental plots at Groblersdal, Hartbeespoort (Brits), Nelspruit, Oudtshoorn, Potgietersrus and Stellenbosch.

Veterinary Research Institute

Post Office Onderstepoort, Pretoria

Dr K.E. Weis: Director

Dr R.D. Bigalke: Deputy Director

Dr T.W. Naudé: Deputy Director

Dr C.J. Howell: Assistant Director (Parasitology and Reproduction)

Dr D.W. Verwoerd: Assistant Director (Virus Diseases)

Dr C.M. Cameron: Assistant Director (Bacterial and Protozoic Diseases)

Dr J.G. Pienaar: Assistant Director (Pathology)

Dr B.J. Erasmus: Assistant Director (Professional/Technical Auxiliary Services)

Dr L.A.P. Anderson: Assistant Director (Biochemistry)

Mr P.J. van Rooyen: Special Grade Control Technician (Vaccine Production)

Mr K.P. Naudé: Assistant Director (Administrative)

The Institute is concerned with research on diseases of stock and game (infectious and others, including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute

Private Bag X2, Irene

Dr J.H. Hofmeyr: Director

Dr P.E. Lombard: Deputy Director

Dr J.C. Oosthuizen: Deputy Director

Mr J.S.A. Landrey: Assistant Director (Stock Improvement)

Dr J.G. Cloete: Assistant Director (Animal Physiology and Nutrition)

Mr W.C.J. Viljoen: Assistant Director (Poultry Science)

Dr J.H. Labuschagne: Assistant Director (Dairy Research)

The Institute, at various centres throughout the country, undertakes at the national level performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig-testing stations at Irene, Cedara and Elsenburg, and bull-testing stations at Queenstown and Omatjenne (South West Africa).

Fruit and Fruit Technology Research Institute

Private Bag X5013, Stellenbosch

Dr P.G. Marais: Director

Dr A.J. Heyns: Director (Personal)

Dr A.C. Myburgh: Assistant Director (Table Grapes, Horticulture, Plant Improvement, Plant Pathology and Entomology)

Dr W.J. Pienaar: Assistant Director (Chemistry, Fruit Processing, Plant Biochemistry, Cold Storage and Radio Isotopes)

The Institute is responsible for research on deciduous fruit, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products. The Institute further renders a radiation and radio-isotope service in connection with agricultural problems in the winter rainfall complex. The Institute controls the research stations and experimental farms at Groot Drakenstein (Bien Donné), Citrusdal, De Doorns, Elgin, Langkloof, Paarl and Robertson.

Oenological and Viticultural Research Institute

Private Bag, Stellenbosch

Dr J. de V. Burger: Director

Dr J. Deist: Deputy Director (1977-09-01)

The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The Institute controls the historic wine farm Groot Constantia.

(e) DIVISIONS

Division of Agricultural Engineering

Private Bag X515, Silverton

Mr J.J. Bruwer: Director

Mr C.T. Crosby: Chief Engineer

Dr B. van D. Boshoff: Chief Engineer

Mr P.J. Pienaar: Assistant Chief Engineer (Soil Conservation Works - Aliwal North)

Mr J.H. Eckard: Assistant Chief Engineer (Mechanization: Plant Production)

Mr J. Veenstra: Assistant Chief Engineer (Mechanization: Animal Production)

Mr C.J. van Schalkwyk: Assistant Chief Engineer (Farm Development)

Mr J.F. la G. Matthee: Assistant Chief Engineer (Winter Rainfall Complex - Stellenbosch)

Mr I. Scheepers: Assistant Chief Engineer (Irrigation Engineering)

Mr H.W.P.W. Struck: Assistant Chief Engineer (Soil Conservation Engineering)

The Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Division of Agricultural Information

Agricultural Building, Private Bag X144, Beatrix Street, Pretoria

Mr D.B. Marais: Director

Mr R.J. van Niekerk: Deputy Director

Mr Q. Momberg: Assistant Director (Publications)

The function of the Division is the distribution of agricultural information by the mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control

Agricultural Building, Beatrix Street, Pretoria

Mr J.F. van Wyk: Director

Mr D.C. Lourens: Deputy Director

Mr A.J. Cronje: Assistant Director (Quality Control)

Mr L.J. Grobler: Assistant Director (Inspection and Control Services)

The functions of this Division include the protection of propagation material and the

assurance of its quality. The Division administers the Seeds Act (Act. 28 of 1961), the Plant Breeders' Rights Act (Act. 22 of 1964) and the Agricultural Pests Act (Act. 3 of 1973).

Division of Soil Protection

Agricultural Building, Beatrix Street, Private Bag X120, Pretoria

Dr J. Serfontein: Director

Mr H.S. Niehaus: Deputy Director

Mr J.L. Vosloo: Assistant Director (Land and Weed Control)

Mr T. Brenkman: Assistant Director (Administrative)

The Division is responsible for the administration of the Soil Conservation Act (Act 76 of 1969), the Weeds Act (Act 42 of 1937), and the Subdivision of Agricultural Land Act (Act 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Division of Veterinary Services

Transvaal Agricultural Union Building, 28† Struben Street, Private Bag X138, Pretoria

Dr J.P. van der Merwe: Director

Dr J.D. Coetzee: Deputy Director

Dr J.M. Erasmus: Deputy Director

Dr A. van Heerden: Assistant Director (Major Disease Eradication Schemes and Notifiable Diseases)

Dr G.C. Dent: Assistant Director (Import and Export Control, Bantu Veterinary Services and Border Control and Nagana Control)

Dr P.P. Bosman: Assistant Director (Regional Diagnostic Services, Training, Extension, Animal Health, Non-notifiable Diseases, A.I. Services, Liaison and Publications)

Dr C.W.A. Belonje: Assistant Director (Eastern Cape and Karoo Region - East London)

Dr A.E. Gillepsie: Assistant Director (Meat Hygiene and Related Matters)

Dr W.M.H. Löwe: Assistant Director (Highveld Region - Potchefstroom)

Dr E.O. le Riche: Assistant Director (Winter Rainfall Region - Stellenbosch)

Dr T.A.T. Louw: Assistant Director (Free State Region - Bloemfontein)

Dr F.B.W. du Casse: Assistant Director (Transvaal Region - Pretoria)

Dr L.R. Hurter: Assistant Director (Northern and Eastern Transvaal Region - Pietersburg)

Dr W.H.B. Bühr: Assistant Director (Natal Region - Pietermaritzburg)

Dr C.J. Coetzee: Assistant Director (SWA Region, South - Windhoek)

Dr C. van N. Jonker: Assistant Director (SWA Region, North - Windhoek)

Mr F. Huisman: Assistant Director (Administrative)

The Assistant Directors of the Regions are under the direct control of the Director. The Division has a specific task in regard to animal health as laid down in the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956) and regulations promulgated in terms thereof. The Division guards against the introduction of diseases by erecting, patrolling and maintaining game- and cattle-proof fences on the borders of the Republic and South West Africa and by controlling animal imports. For domestic protection regular inspections of all stock are carried out. The promotion of animal health schemes to eradicate certain diseases and animal health in general enjoy high priority. The Division also has four Regional Veterinary Laboratories throughout the Republic and South West Africa for local investigation of stock losses, problems relating to animal health and suboptimal production and reproduction. In terms of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), the Division is responsible for the promotion and maintenance of hygiene in cattle slaughterings and handling of meat and animal products, for preventing the transmission of diseases to human beings and animals by disease-infected animals, meat or animal products, for preventing cruelty to animals slaughtered at abattoirs and for controlling the importation of meat.

(f) AGRO-ECOLOGICAL REGIONS

The eight Regional Organisations of the Republic, as well as of South West Africa, are responsible within their respective geographical areas, for the planning, development, promotion and application of farming systems based on optimal land utilisation.

Each of these organisations provides an extension service in which the soil conservation effort is integrated and which also covers every aspect of farming. The research services are directed to the collation and releasing of scientific knowledge for the optimal utilisation of the natural agricultural resources. The research personnel are also responsible for specialist extension work and for supplying training services to the agricultural colleges.

Eastern Cape Region

PO Box 233, Queenstown

Dr P.W. Roux: Director

Mr J.H. Stapelberg: Deputy Director

Mr J.L. van der Walt: Assistant Director (Research)

Mr B.J. Krige: Assistant Director (Extension) (1977-08-01)

Research stations: Dohne (central research station) at Stutterheim, and Bathurst (Port Alfred). A number of experiments are also conducted at East London.

Free State Region

Agricultural College, Glen

Dr S.W. Pienaar: Director

Mr W.S. Grobbelaar: Deputy Director

Dr P.J. Niemann: Assistant Director (Research)

Mr G.W. Oosthuizen: Assistant Director (Extension)

Mr G.W. Long: Assistant Director (Administrative)

Glen College of Agriculture. Research stations and experimental farms: Glen (central research station), Armoedsvlakte (Vryburg), Koopmansfontein (Barkly West), Rietrivier (Herbert), Sandvet, Sydenham, Upington Complex and Vaalharts (Jan Kempdorp)

Highveld Region

Private Bag X804, Potchefstroom

Dr J.D. Slabber: Director

Dr F.J. Kok: Deputy Director

Dr W.P. Grobbelaar: Deputy Director (Summer Grain Centre - Potchefstroom)

Mr J. de Kock: Assistant Director (Summer Grain Centre - Potchefstroom) (1977-08-01)

Mr J.D. Basson: Deputy Director (Small Grain Centre - Bethlehem)

Mr G.J. Carstens: Assistant Director (Small Grain Centre - Bethlehem)

Mr K.W. Pakendorf: Assistant Director (Small Grain Centre - Bethlehem) (1977-08-31)

Dr J.J. Coetzee: Assistant Director (Extension)

Mr M.C. Walters: Assistant Director (Research)

Grootfontein College of Agriculture. Research stations and experimental farms: Potchefstroom complex (central research station), Bethlehem and Swartrand (for gousiekte research) at Ventersdorp.

Karoo Region

Agricultural College, Grootfontein, Middelburg, CP

Dr W.J. Hugo: Director

Mr. C.R. Baard: Deputy Director

Mr J.A.A. Baard: Assistant Director (Research)

Dr A.J. Siepker: Assistant Director (Extension)

Grootfontein College of Agriculture. Research stations, experimental farms: Grootfontein, Middelburg, CP (central research station), Carnarvon, Tarka Conservation Area, Hales Flats and Jansenville

Natal Region

Private Bag X9021, Pietermaritzburg

Dr P. Hildyard: Director

Mr R.H. Peard: Deputy Director

Dr J.W.C. Mostert: Assistant Director (Research)

Dr D.M. Scotney: Assistant Director (Extension)

Mr D.E. Foster: Assistant Director (Administrative)

Cedara College of Agriculture. Research stations, experimental farms: Cedara (Central Research Institute), Drakensberg Complex, (Estcourt); Northern Natal (Dundee); Kokstad and Pongolapoort (Makatini).

South West Africa Region

Private Bag X13184, Windhoek

Dr L. Mostert: Director

Mr J.H. Loubser: Deputy Director

Mr C.H. de Klerk: Assistant Director (Extension)

Dr P.J. le Roux: Assistant Director (Research)

Neudam College of Agriculture. Research stations, experimental farms: Gellap 'Ost (Keetmanshoop), Hardap (Mariental), Kalahari (Stampriet), Neudam (Windhoek), Omatjenne (Otjiwarongo), Sandveld (Gobabis), Sonop (Grootfontein) and Uitkomst (Grootfontein)

Transvaal Region

Agrivaal Building, Cor Edmund and Hamilton Streets, Private Bag X180, Pretoria

Mr D.F. de Wet: Director

Mr S.J. Gericke: Deputy Director

Dr M.K.S.L. von La Chevallerie: Assistant Director (Research)

Mr W.H. de Vos: Assistant Director (Extension)

Mr J.A. van Niekerk: Assistant Director (Administrative)

Research stations, experimental farms: Roodeplaat (central research station), Rietondale, Soutpan (Pretoria), Athole (Amsterdam), Loskop (Groblersdal), Mara (Louis Trichardt), Messina, Nooitgedacht (Ermelo) and Towoomba (Warm Baths).

Winter Rainfall Region

J.S. Marais Building, Private Bag X5023, Stellenbosch

Dr J.E. Erasmus: Director

Dr P.J.S. Pieterse: Deputy Director

Mr A. Viljoen: Deputy Director

Dr J.E. van Niekerk: Assistant Director (Research)

Mr D.J. van Z. Smit: Assistant Director (Extension)

Mr H.C. du Preez: Assistant Director (Administrative)

Stellenbosch-Elsenburg College of Agriculture. Research stations and experimental farms: Elsenburg, Mariendal and Welgevallen (Stellenbosch), Langgewens (Morreesburg), Nortier (Lambert's Bay) Oudtshoorn, Outeniqua (George), Tygerhoek (Riviersonderend) and the Veld Reserve at Worcester.

(2) ADVISORY PRODUCTION COMMITTEES

The following is a list of the various production committees operating in the Department. The committees consist of representatives of this department, other interested Departments, organized agriculture, the control boards and the various branches of the agricultural industry.

They were constituted for the purpose of creating liaison between the above-mentioned

bodies, to solve problems arising in the different agricultural industries and to promote production.

Most of these committees are reconstituted every three years.

A. PLANT PRODUCTION

1. ADVISORY COMMITTEE FOR COFFEE PRODUCTION

Department of Agricultural Technical Services

Dr J.H. Grobler (Chairman)

Mr R.H. Peard

Department of Agricultural Economics and Marketing

Mr J. de J. Jooste

Department of Bantu Administration and Development

Mr J.J. Lutz

Department of Commerce

Mr J. Jooste

Coffee Growers Association of South Africa

Dr G.H. Shuker

Mr P. Mayne

Mr E.W. Steward

South African Tea, Coffee and Chicory Association

Mr O.P. Kelly

2. ADVISORY COMMITTEE FOR PINEAPPLE PRODUCTION

Department of Agricultural Technical Services

Dr J.H. Grobler (Chairman)

Mr J.H. Stapelberg

Mr L. Ginsburg

Mr R.H. Peard

Perishable Products Export Control Board

Mr J.M. Bester

Fruit and Vegetable Canners Association

Mr J.R. Burg

3. ADVISORY COMMITTEE FOR CITRUS PRODUCTION

Department of Agricultural Technical Services

Dr J.H. Grobler (Chairman)

Dr I.H. Wiese

Mr A. van Oostrum

Mr J.H. Stapelberg

Mr S.J. Gericke

Mr L. Ginsburg

Citrus Board

Mr D.C. Lötter

Mr N.C. Lodewijks

Mr D. Raubenheimer

Dr D.A. Stanton

Mr M.B. Georgala

Mr G.F. Malan

Mr T.F.S. Malherbe

Mr H.J. van Baalen

South African Agricultural Union

Mr F. Meyer

Bantu Investment Corporation

Dr D. Bester

University of Pretoria

Dr L.C. Holtzhausen

Perishable Products Export Control Board

Mr J.M. Bester

4. ADVISORY COMMITTEE FOR DECIDUOUS FRUIT PRODUCTION

Department of Agricultural Technical Services

Dr P.G. Marais (Chairman)

Dr J. de V. Burger

Mr E. Strydom
Mr A. Kriel
Mr M.S. le Roux

Deciduous Fruit Board
Mr G.D. Kilpin
Mr A. v. Niekerk
Mr G.C. Burger

South African Agricultural Union
Mr H.J. Ligthelm
Mr H.J. van Niekerk
Mr W.T. Steward
Mr J.E. Nel

Dried Fruit Board
Mr D.C. Viljoen

SA Fruit and Vegetable Canners Association
Mr H.J. Visagie

Perishable Products Export Control Board
Mr J.M. Bester

Canning Fruit Control Board
Mr A.S. von M. Fullard

Cape Pomological Association
Mr R. Dalton

University of Stellenbosch
Prof. D.K. Strydom

5. ADVISORY COMMITTEE FOR FOOD TECHNOLOGICAL MATTERS

Department of Agricultural Technical Services
Dr P.G. Marais (Chairman)
Dr J.H. Grobler

University of Stellenbosch
Dr B.H. Koepen

Department of Agricultural Economics
and Marketing
Mr F.J. le Roux

Food Research Institute of the CSIR
Mr J.P. de Wit

SA Citrus Juice Manufacturers
and Exporters Association
Mr M. Wall

SA Fruit and Vegetable Canners Association
Mr J. Lombard
Mr N.C. Goosen
Mr S. Wood

SA Federated Chamber of Commerce
Mr E.R. Newbary

Deciduous Fruit Board
Mr G.D. Kilpin

Apricot and Peach Producers Association
Mr A.S. Fullard

Citrus Board
Mr A.F.G. Smith

Dried Fruit Board
Mr D.C. Viljoen

Department of Health
Dr P.N. Swanepoel

South African Agricultural Union
Mr H.B. Lombaard

Metal Box South Africa Ltd.
Mr J.H. Hofmeyr

6. ADVISORY COMMITTEE FOR WINE PRODUCTION

Department of Agricultural Technical Services
Dr J.D. Burger (Chairman)
Dr A.J. Heyns
Mr G.W. Oosthuizen
Mr J.J. Bruwer
Mr A.F. Kriel

KWV
Mr L.N. Jonker
Mr P.B.B. Hugo
Mr W.J. van Zyl
Mr W.S. Smit
Dr J.A. van Zyl

Cape Wine and Spirits Institute
Mr R.R. Melck
Mr H.M.E. Flockmann
Dr P.J. Venter

Dried Fruit Board
Mr D.C. Viljoen

Stellenbosch Estate Wines (Coop.) Ltd.
Mr F.J. Malan

Cooperative Wine Cellars Committee
Mr J.S. Odendaal

Coordinating Committee of the Western
Cape Growers Association
Mr H.F. Smit

University of Stellenbosch
Prof. C.J. Orffer
Prof. C.J. van Wyk

Department of Agricultural Economics
and Marketing
Mr J.S.G. Joubert

7. ADVISORY COMMITTEE FOR TOBACCO PRODUCTION

Department of Agricultural Technical Services
Mr J.F. Peens (Chairman)
Dr A.J. Pienaar

Central Cooperative Tobacco Company
of SA Ltd.
Mr H.G. Wenhold
Mr A.J. de Jager
Mr J.W. Louw
Mr J.A. Opperman
Mr J.D.R. Henstock
Dr W.P. Kolver

Tobacco Manufacturers Committee
Mr V.I. Breytenbach

Tobacco Board
Mr E.C. Schutte

Appointed by the Minister of Agriculture
Dr F.W. van Zyl

8. ADVISORY COMMITTEE FOR BANANA PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Grobler (Chairman)
Mr S.J. Gericke

Department of Agricultural Economics
and Marketing
Mr D.C. van Zyl

South African Agricultural Union
Mr M. Tooley
Mr P.E.R. Redelinghuys

Banana Control Board
Col C.J. Huyzers
Mr J.R. Minnaar

9. ADVISORY COMMITTEE FOR DRY BEAN PRODUCTION

Department of Agricultural Technical Services
Dr A.J. Pienaar (Chairman)
Dr J.W. Snyman
Mr A.J. Liebenberg

Department of Agricultural Economics
and Marketing
Mr H.S. Hattingh

South African Agricultural Union
Mr J.J. van Wyk
Mr H.J. Engelbrecht
Mr J.J. van Rooyen

SA Fruit and Vegetable
Canners Association
Mr R.O. Brown

Dry Bean Control Board
Mr L.B. Rothman
Mr C.D. Kruger

Food Research Institute of the CSIR
Mr J.P. de Wit

**10. ADVISORY COMMITTEE FOR POTATO
PRODUCTION**

Department of Agricultural Technical Services
Mr D.F. de Wet (Chairman)
Mr F.I. du Plooy
Mr D.C. Lourens
Dr J.E. van der Plank

The SA Fertilizer Society
Mr O.G. Smith

South African Agricultural Union
Mr M.F. Crick
Mr H.J. Pieterse

Potato Board
Mr P.L. Steyn
Mr P.J. Farrel

Seed Potato Producers Union
Mr T. Cook
Mr D.J. van Rensburg

Department of Agricultural Economics
and Marketing
Mr J.S.G. Joubert

**11. ADVISORY COMMITTEE FOR SUMMER GRAIN
PRODUCTION**

Department of Agricultural Technical Services
Dr A.J. Pienaar (Chairman)
Dr J.D. Slabber
Dr P. Hildyard
Dr W.P. Grobbelaar

Department of Agricultural Economics
and Marketing
Mr H.S. Hattingh

Maize Board
Mr B. Wilkens
Mr H. Hickley

SA Fertilizer Association
Dr P.C. Möhr

South African Agricultural Union
Mr M. van der Hoven
Mr M. Daling

Transvaal Agricultural Union
Mr J.T. van Eeden

OFS Agricultural Union
Mr W.M. Leonard

Sentrale Westelike Koöperasie
Mr J.C. Steyn

Oostelike Transvaalse Koöperasie
Mr D. de Wet

Noordwes Koöperasie
Dr A. Scholtz

B. ANIMAL PRODUCTION

**1. ADVISORY COMMITTEE FOR THE PRODUCTION
OF WOOL**

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)

Dr W.J. Hugo
Dr P.R. Mansvelt

Department of Agricultural Economics
and Marketing
Mr H.S. Hattingh

Department of Bantu Administration
and Development
Mr W.F. Waugh

Wool Board
Mr G.A. Agenbach
Mr A. Paul

SA Wool and Textile Research Institute
Dr D.P. Veldsman

Merino Stud Breeders Association of SA
Mr O.J.M. van den Heever

SA Wool and Mohair Brokers Association
Mr N.J. Vlok

SA Wool and Mohair Buyers Federation
Comdt R.D.L. Davis

National Wool Growers Association
Mr P.W. van Rooyen
Mr H.F. Prinsloo

**2. ADVISORY COMMITTEE FOR SHEEP
PERFORMANCE AND FLEECE-TESTING
SERVICES**

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)

SA Stud Book Association
Mr A.R.D. Halse
Mr Dodds Pringle

Meat Board
Mr A.M. Wessels

Merino Stud Breeders Association of SA
Mr O.J.M. van den Heever

Wool Board
Mr H.F. Prinsloo

Karakul Breeders Association of SA
Dr S.J. Schoeman

**3. ADVISORY COMMITTEE FOR KARAKUL SHEEP
PRODUCTION**

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr L. Mostert
Dr L.J.F. von Maltitz
Mr D.A. Boshoff

Department of Agricultural Economics
and Marketing
Mr C.D. Kruger

Karakul Board
Dr H.J. van Hase

Karakul Breeders Association of SA
Mr J.J. Bouwer

South West African Agricultural Union
Mr W. Barnard
Mr M.O. Baartman

**4. ADVISORY COMMITTEE FOR MOHAIR
PRODUCTION**

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr W.J. Hugo
Dr J.P. v.d. Merwe

Department of Agricultural Economics
and Marketing
Mr J. de J. Jooste

SA Wool Textile Research Institute
Dr D.P. Veldsman

SA Mohair Producers Association
Mr J.F. Froehlich

Angora Stud Breeders Association of South Africa
Mr J.D.D. Kettlewell

Mohair Board
Mr H.H. Coetzer
Mr D.A. Hobson
Mr D.S. Uys (Co-opted)

5. ADVISORY COMMITTEE FOR BEEF, MUTTON AND GOAT MEAT

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. v.d. Merwe
Dr L. Mostert

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

Meat Board
Mr G.H. Gluckman
Mr S.J.J. van Rensburg
Mr R.J. Theunissen
Mr P.J. Pretorius
Dr J.H. Lombard
Mr A.P. Pretorius

Department of Bantu Administration and Development
Mr W.F. Waugh

South African Agricultural Union
Mr P.R. du Toit
Mr J.P. Smit
Mr F.P. Möller
Dr J.S. Starke

6. ADVISORY COMMITTEE FOR DAIRY BULL TESTING

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Mr J.S.A. Landrey

Friesland Cattle Breeders Society of South Africa
Mr T.E.M. Murray

Ayrshire Cattle Breeders Association of South Africa
Mr J.M. Walker

SA Guernsey Cattle Breeders Society
Mr D.C. Hart

Jersey Cattle Breeders Society
Mr H.M. de Villiers

Artificial Insemination Co-operatives
Dr C.T. McDonald

Central Milk Recording Co-operative
Mr P.L. Barnard

7. ADVISORY COMMITTEE FOR THE NATIONAL BEEF CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. v.d. Merwe

South African Agricultural Union
Mr P.R. du Toit

Meat Board
Mr S.J.J. van Rensburg
Mr A.P. Pretorius
Mr A.E. Hambly
Mr J.F. Vercueil

South African Stud Book Association
Mr R.J. Theunissen
Mr A.R.D. Halse

8. ADVISORY COMMITTEE FOR MILK RECORDING

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Mr J.S.A. Landrey

Milk Recording Cooperatives
Mr P.L. Barnard
Mr D. Houston
Mr G.B. Newcombe

SA Stud Book Association (Milk Breeds)
Mr T.E.M. Murray

Artificial Insemination Cooperatives
Dr C.T. McDonald

Milk Board
Mr F.G. Bekker

Dairy Board
Mr J.J.M. van Vuuren

SA Agricultural Union
Mr E.H. Nolte

9. ADVISORY COMMITTEE FOR DAIRY PRODUCTION AND TECHNOLOGY

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.C. Oosthuizen

Department of Agricultural Economics and Marketing
Mr J.P. van der Walt

SA Agricultural Union
Mr C.J. Newcombe
Mr J.J.M.J. van Vuuren

Dairy Products Manufacturers Association
Mr L. Stein
Dr M.N. Hermann

Milk Distributors Association
Mr T.C. Rijs

Dairy Board
Mr P.J.H. Maree

Milk Board
Mr A.C. Visser

SA Dairy Technology Association
Mr P.H. Lishman

10. ADVISORY COMMITTEE FOR PIG MEAT PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr P.P. Bosman

Department of Agricultural Economics and Marketing
Mr J. de J. Jooste

SA Pig Development Association
Mr S. Saffer
Dr W.A. Vosloo

Meat Board
Mr G.H. Braak
Mr P.J. Pretorius

SA Pig Breeders Society
Mr A. Webber

SA Agricultural Union
Mr J.B. Haasbroek

11. ADVISORY COMMITTEE FOR PIG TESTING

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr P.P. Bosman

SA Pig Breeders Society
Mr R.N. Barnes

Meat Board
Mr G.M. Braak
Pig Industry Committee
Mr S. Saffer

12. ADVISORY COMMITTEE FOR POULTRY PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr P.R. Mansvelt

Department of Agricultural Economics
and Marketing
Mr C.D. Kruger

Egg Board
Mr D. Jacobs

SA Poultry Association
Mr P.J. Serfontein
Mr S.C. Methven

SA Agricultural Union
Mr A.E. Karlsen

13. ADVISORY COMMITTEE FOR RANDOMISED EGG-LAYING AND BROILER TESTS

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Mr W.C.J. Viljoen
Dr P.P. Bosman

SA Poultry Association
Mr M. Oosthuizen
Mr J. Serfontein
Mr A.L. McCarthy
Mr J. Mervish
Dr G. Faber

SA Agricultural Union
Mr J.H. du Plessis

14. ADVISORY COMMITTEE FOR BEE-KEEPING

Department of Agricultural Technical Services
Dr I.H. Wiese (Chairman)
Dr R.H. Anderson
Dr D.J.C. Fletcher

Department of Agricultural Economics
and Marketing
Mr P.J. Wessels

Department of Forestry
Mr M. v.N. Möhr

SA Federation of Bee-keepers Association
Mr R. Guy
Mr K. Voges
Mr F. Steinhobel
Mr R. Flinn
Mr P.N. Mountain
Mr G. Altona
Maj. Genl. G.D. Moodie
Mr J. Smith

15. ADVISORY COMMITTEE ON THE ANIMAL SLAUGHTER, MEAT AND ANIMAL PRODUCTS HYGIENE ACT, (ACT 87 OF 1967) AND ITS APPLICATION

Department of Agricultural Technical Services
Dr J.P. v.d. Merwe (Chairman)
Dr J. Coetzee
Mr C.S. de Villiers

Department of Agricultural Economics
and Marketing
Mr J.P. van der Walt

Department of Health
Dr J.G. Oberholster

Meat Board
Dr F.J. van Biljon

Mr G.H. Braak
Mr G.N. Gluckman
Mr S.J.J. van Rensburg
Mr G.J.K. Marais (Acting)

United Municipal Management of South Africa
Dr C.R. Mackenzie

SA Veterinary Society
Dr M.M. Greathead

Abattoir Commission
Prof. L.W. van den Heever

C. STATUTORY BOARDS

1. VETERINARY BOARD

Department of Agricultural Technical Services
Dr B.C. Jansen (Chairman)

University of Pretoria
Prof. C.F.B. Hofmeyr

SA Veterinary Society
Prof. L.W. van den Heever
Dr R.I. Coubrough
Prof. H.P.A. de Boom

Department of Justice
Mr M.J. Prins

2. ARTIFICIAL INSEMINATION BOARD

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. v.d. Merwe

SA Studbook Society
Mr A.L. Doidge
Mr T.E.M. Murray
Mr R.J. Theunissen
Mr A.R.D. Halse
Mr H.M. de Villiers

Artificial Insemination Centres
Dr A.B. la Grange
Dr C.T. MacDonald

SA Society of Animal Production
Dr J.H. Lombard

SA Veterinary Society
Dr A.P. Schutte

SA Agricultural Union
Mr S.H.J. Brits
Mr P.L. Barnard
Mr B. MacLaghlan
Capt. A. Sol
Mr W.C. Malan, M.P.

D. OTHER ADVISORY COMMITTEES

1. ADVISORY COMMITTEE FOR THE TESTING OF AGRICULTURAL ENGINEERING EQUIPMENT

Department of Agricultural Technical Services
Mr J.J. Bruwer (Chairman)
Mr C.T. Crosby

Department of Agricultural Economics
and Marketing
Mr C.D. Kruger

SA Agricultural Union
Mr C.F. Vosloo

SA Agricultural and Irrigation Machinery
Manufacturers Association
Mr L. Lee

SA Institute of Agricultural Engineers
Prof. P.J.C. Vorster

National Agricultural Machinery
Traders Association
Mr A. von Eckardstein

CSIR
Mr E.R. Leeman

SA Bureau of Standards
Mr P. Scribante

University of Natal
Mr P. Meiring

University of Pretoria
Prof. B.J.G.W. Grobler

2. ADVISORY COMMITTEE FOR THE TRAINING OF PROSPECTIVE FARMERS

Department of Agricultural Technical Services
Dr D.J. Agenbach (Chairman)
Dr J.E. Erasmus
Dr J.D. Slabber
Dr S.W. Pienaar
Dr W.J. Hugo
Dr L. Mostert
Dr P. Hildyard

SA Agricultural Union
Mr A.J. Basson
Mr J. Wilkens

Department of National Education
Mr J.H. Swiegers

Department of Agricultural Economics
and Marketing
Mr J.K. Siertsema

3. ADVISORY COMMITTEE FOR BOTANICAL RESEARCH

Department of Agricultural Technical Services
Dr B. de Winter (Chairman)
Dr D.J.B. Killick
Dr D. Edwards

Department of Forestry
Dr H.A. Lückhoff

National Botanic gardens of SA
Prof. H.B. Rycroft

National Parks Board of Trustees
Mr P. van Wyk

Interprovincial Nature Conservation Committee
Mr P. le Roux

SA Association of Botanists
Prof. O.A. Lewis
Prof. H.M. van der Schijff
Prof. C.F. Cresswell
Prof. N. Grobbelaar
Prof. E.A. Schelpe
Prof. M.C. Papendorf

4. SOIL PROTECTION ADVISORY BOARD

Department of Agricultural Technical Services
Dr D.J. Agenbach (Chairman)
Dr J. Serfontein

Representatives of Regional Advisory Committees
Mr T.F. Dreyer
Mr J.A. Jooste
Mr H.P. van der Walt
Mr P.E. van Papendorp
Mr T.N. van Lill
Mr J.C. Grobler
Mr J.J. du Plessis
Mr M.G. Reynolds

SA Agricultural Union
Mr H.P. van der Walt

Nominated by the Minister of Agriculture
Mr W.C. van den Heever

5. TECHNICAL LIAISON COMMITTEE FOR THE PRODUCTION OF TEA

Department of Agricultural Technical Services
Dr J.H. Grobler (Chairman)

Department of Bantu Administration
and Development
Mr J.J. Lutz

Tea Producers
Mr D.J. Pennwill
Dr P.P. du T. Deetlefs

6. SELECTION COMMITTEE FOR THE IMPORT OF DECIDUOUS FRUIT CULTIVARS

Department of Agricultural Technical Services
Dr P.G. Marais (Chairman)
Mr J.N. Horn
Mr H.P. van Heerden
Mr D.J. Engelbrecht
Dr J.T. Meynhardt

Canning Fruit Board
Mr A.S. von M. Fullard

University of Stellenbosch
Prof. D.K. Strydom

Cape Pomological Society
Mr J.E. Mudge

Dried Fruit Board
Mr. S.C. Rautenbach

Deciduous Fruit Board
Mr G.W. Larmuth

Deciduous Fruit Plant Improvement Scheme
Mr G.C. Burger

SA Nurserymen's Association
Mr I.B. Nel

7. ADVISORY COMMITTEE REGARDING RESEARCH GRANTS BY THE DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES TO UNIVERSITIES

Department of Agricultural Technical Services
Dr J.C. Strydom (Chairman)
Dr B.C. Jansen
Prof. S.A. Hulme

University of Pretoria
Prof. C.F.B. Hofmeyr
Prof. D.J.J. Potgieter

University of Stellenbosch
Prof. H.A. Louw

University of the OFS
Prof. H.A. Kotzé

University of Natal
Prof. K. Nathanson

Office of the Scientific Adviser
to the Prime Minister
Dr C.G. Coetzee

(3) AGRICULTURAL TECHNICAL RELATIONS WITH FOREIGN COUNTRIES

CO-OPERATION WITH AFRICAN COUNTRIES

SARCCUS conferences and meetings attended

Nature of meeting	Time	Place	SA delegates
Visits to SARCCUS member countries for discussions SARCCUS congress	1976-10-12 to 1976-11-06	Swaziland, Lesotho, Botswana, Malawi and Rhodesia	Mr D.C. Lourens Mr H.P. van Heerden
	1977-03-22 to 1977-03-25	Malawi	Mr D.F. de Wet Mr H.P. van Heerden Dr H.D. Brown Mr J.F. van Wyk Dr I.H. Wiese
Standing Committees: Animal health	1976-10-18 to 1976-10-22	Pretoria	Dr W.A. Verbeek Dr P. Bosman Dr C. Dent Dr J.P. v.d. Merwe Dr A. van Heerden
Animal production	1976-10-18 to 1976-10-22	Pretoria	Dr W.A. Verbeek Dr J.G. Cloete Dr J.H. Hofmeyr Dr M.E.L. Buys
Hydrology	1976-07-02	Pretoria	Dr D. Edwards
Nature conservation, wild life utilisation and control	1976-10-04 to 1976-10-08	Stellenbosch	Dr W.A. Verbeek
Education and extension	1976-11-22 to 1976-11-24	Pretoria	Dr F.J. Kok Mr H.P. van Heerden
Subcommittees: Phytosanitary control	1977-02-22 to 1977-02-24	Stellenbosch	Mr K.P. Naudé
Red-billed finch control	1977-02-16	Pretoria	Mr I.G. Venter Dr D. Edwards
Water weeds	1976-07-02	Pretoria	Dr H.C. Kühn
Co-operation with countries in connection with SARMEIT	1977-02-08 to 1977-02-22	Rhodesia, Swaziland, Botswana	

Visitors from African countries

Name of visitor	Country and institution	Period of visit	Purpose of visit	Institutions visited
Mr G. Chabwera	Zambia: Secretary of the Agricultural Marketing Board	1976-05-14	To obtain information on the exporting of potatoes to Zambia	Plant and Seed Control
Mr G. Easterbrook	Rhodesia	1976-07-20	Interview with professional officers	Plant and Seed Control
Mr H. Elwell	Rhodesia	November 1976	Study of research at Region	Natal Region
Mr K.B. Hanssen	Rhodesia	1976-04-13	To obtain information on seed	Plant and Seed Control
Mr M.J. Herring	Rhodesia	October 1976	Discussions on the constitution of a committee on sunflowers	Crops and Pastures
Mr K. Kumwanda	Zambia	1976-05-14	To obtain information on the exporting of potatoes to Zambia	Plant and Seed Control
Mr Luhanga Mr Chipetta Miss P. Mtambo Dr R.L. MacKenzie	Malawi Rhodesia	1977-04-18 to 1977-04-29 1976-05-05	To study seed control Discussions on control measures	Plant and Seed Control Veterinary Services
Mr B. Masia	Lesotho	1976-06-02	Discussions with the seed analyst	Plant and Seed Control
Mr J.N. Matjie	Bophuthatswana: Senior Officer of the Department of Agriculture	1977-06-13 to 1977-06-17	To obtain information on the work of various divisions	Plant and Seed Control, Onderstepoort, Veterinary Services and Engineering
Mr Mookodi Miss Malebese Miss Ntsane Mr Mbokodi Mr Ntloko Dr J.C. Robinson	Transkei Lesotho Transkei Rhodesia	1976-07-12 to 1976-07-16 1977-07-12 to 1977-07-16 August 1976 1977-03-07	Sight-seeing tour To study the latest seed-testing techniques Educational visit Discussions on plant introduction	Plant and Seed Control Plant and Seed Control Horticulture Plant and Seed Control
Dr Saunders	Rhodesia: Director of Agricultural Research	1976-04-15	Discussions	Plant and Seed Control

Name of visitor	Country and institution	Period of visit	Purpose of visit	Institutions visited
Speaker and five Members of Parliament	Malawi	1976-11-29	Sight-seeing tour	Horticulture
Mr Saul	Rhodesia	1977-03-04	Courtesy visit	Plant and Seed Control
Mr Hobbs	Malawi	1977-02-25	To see the seed-testing station	Plant and Seed Control
Dr Sediki			Discussions on the possible resumption of imports of pork carcasses from Bulawayo to South Africa	Veterinary Services
Mr Chupola	Rhodesia	1977-03-15 to 1977-03-15		
Dr J.W. Thomson				
Mr D.B. Vickers	Rhodesia	1976-07-16	Sight-seeing tour	Onderstepoort

Visitors to African countries

Purpose of visit	Date	Place	SA officer(s)
Inspection of abattoirs and meat-processing factories to establish whether these places still comply with the specifications for the exportation of meat to SA	May 1976	Rhodesia, Botswana and Swaziland	Dr J.D. Coetzee
Investigation into territorial planning	1976-06-21 to 1976-07-02	Rhodesia	Mr R.W. Nott Mr J.A. Smit Mr E.P. Evans
Visit to Rhodesian Deciduous Fruit Growers' Association	1 week in October 1976	Rhodesia	
To open the Grain Mech 76 Congress in Salisbury	1976-06-24	Rhodesia	Mr C.F. Crosby
Visit to the Mazoe Citrus Estate	3 days, 1976	Rhodesia	Dr J.M. Moll
Presentation of a course on sheep breeding and wool classification	1976-10-30 to 1976-11-26	Lesotho	Mr J.M. Cloete Mr C.E. Pettit
Investigation of red scale on citrus in Rhodesia	1977-01-31 to 1977-02-02	Rhodesia	Dr E.C.J. Bedford
Visit to the Inyanga area for potato research and production of AA seed potatoes	1977-01-24 to 1977-01-26	Rhodesia	Mr C.J. Hunlun
Visit to Rhodesia to effect closer contact and co-operation with oilseed researchers	1977-03-21 to 1977-03-26	Rhodesia	Dr J.W. Snyman
Visit to collect plant material	1977-03-14 to 1977-03-30	Swaziland	Dr H.R. Tolken Dr R.E. Magill
Inspection of abattoirs and meat-processing factories to determine whether those places still comply with the requirements for meat exports	1977-07-17 to 1977-07-30	Rhodesia, Botswana, Swaziland	Dr A.E. Gillespie
Opening of farmers' day on 7 July and guest of Grain Mech 77 on 8 July 1977	1977-07-07 to 1977-07-08	Rhodesia	Mr J.J. Bruwer
Study visit to study Culicoides with Dr Y. Braverman	1977-05-07 to 1977-05-14	Rhodesia	Mr E.M. Neville

OVERSEAS VISITS

Congresses, meetings and symposia

Meetings attended	Time	Place	SA delegate
15th International Congress on Animal Blood Groups in Dublin	1976-06-18 to 1976-07-17	Ireland	Mr E.H.H. Meyer
1976 CORESTA congress and participation in the proceedings of the Agronomy and Pathology Study Group in Tokyo	1977-11-10 to 1977-11-27	Japan	Mr R.J. van Wyk
10th International Symposium on Virus Diseases in Deciduous Fruit in Heidelberg, and the 6th meeting of the International Council for the Study of Viruses of the Grapevine in Madrid	1976-09-06 to 1976-09-22	Germany, Spain	Mr D.J. Engelbrecht
ACTIM course on French oenological material	1976-08-30 to 1976-10-29 plus language course	France	Mr H.J. Snyders
Combined congress of the World Federation of Rose Societies and the centenary of the Royal National Rose Society	1976-07-02 to 1976-07-08	England	Dr P.J. Klessner
Meeting of the executive committee of the World Veterinary Association in Paris on 22 May 1976	1976-05-21 to 1976-05-23	France	Dr B.C. Jansen
Course on the breeding and management of pigs	1976-03-28 to 1976-04-09	Scotland	Mr M.C. Henderson
International congress on plant growth regulants	1976-08-30 to 1976-09-04	Switzerland	Dr K.L.J. Blommaert
	1976-06-18 to 1976-07-18	VSA	Mr J.J. Bruwer

Meetings attended	Time	Place	SA delegate
European meeting of meat research workers	1976-09-18 to 1976-08-21	USA, Sweden	Dr R.T. Naudé
Symposium on foot-and-mouth disease at Lyons	1976-10-04 to 1976-10-08	France	Dr A. Pini
International congress on entomology	1976-08-19 to 1976-08-27	USA	Dr D.J.C. Fletcher
Inter-conventional meeting of the International Seed Testing Association (ISTA) and celebration of the centenary of the Swedish seed testing association in Stockholm	May 1976	Sweden	Mr J.F. van Wyk
Annual meeting of the seed certification authorities of the OECD in Paris	April 1976	France	Mr L.J. Grobler
OIE congress on animal health	1976-05-13 to 1976-06-20	France	Dr P.P. Bosman
General meeting of the OIV	1976-08-22 to 1976-09-08	Yugoslavia	Dr J.D. Burger
Committee meeting of the OIV's committee on analytical methods, the inspection of wine and wine microbiology	1976-04-19 to 1976-05-14	France	Mr H.J. du Toit
9th session of the Codex Alimentarius Committee for Pesticide Residues in Amsterdam	March 1977	The Netherlands	Mr C. Kok
Symposium on the Burroughs B6700 computers	1976-04-01 to 1976-05-01	USA, Canada	Dr J. Bot
Extension course	1976-06-28 to 1976-07-23	The Netherlands	Mr G.J. Smit
Symposium on plant relations	1976-05-10 to 1976-05-14	Australia	Mr C.H. de Klerk
International congress on agrochemicals	1976-06-13 to 1976-06-18	Israel	Dr V.D. Wasserman
4th symposium on virus diseases in ornamentals, held in Noordwyker	1976-04-20 to 1976-05-13	Holland	Mr J.H. Jones
Annual meeting of the International Dairy Federation	1976-09-23 to 1976-10-16	Canada	Dr H.C.H. Hahne
Symposium on bees in Morelbeker, Belgium	1976-07-13 to 1976-07-16	Belgium	Dr P.J. Klesser
Wool congress	1976-08-23 to 1976-08-27	Australia	Dr J.C. Oosthuizen
Wool congress in Perth	1976-08-23 to 1976-08-27	Australia	Mr B. Buys
8th international course on irrigation science	1976-10-14 to 1976-12-10	Israel	Dr J.H. Hofmeyr
The conference of the Society of Engineers for the Milk and Dairy Industry and the Central Society of German Dairy Experts and Dairymen, to read a paper	1976-09-17 to 1976-09-23	Germany	Mr G.J. Erasmus
Training on the B7700 computer	1976-10-11 to 1976-11-12	USA	Mr T.E. Döhse
4th international congress on infectious diseases of horses, held at Lyons	1976-09-22 to 1976-09-29	France	Dr H. Lück
Training on the electron microscope	1976-08-30 to 1976-09-03	Germany	Mr J.P.D. van Wyk
10th session of UPOV at Geneva at the invitation of the International Union for the Protection of New Varieties of Plants	1976-10-13 to 1976-10-15	Switzerland	Dr B.J. Erasmus
International congress on entomology	1976-08-19 to 1976-08-27	USA	Mr H.J. Els
Weeds conference in Brighton	1976-11-13 to 1976-12-07	England	Mr J.P. van Wyk
Government consultation on the International Plant Protection Convention in Rome and UPOV board meeting in Geneva	1976-11-15 to 1976-11-19	Italy, Switzerland	Dr Y. Ben-Dov
18th congress of the International Seed Testing Association in Madrid	1977-05-03 to 1977-05-20	Spain	Mr I.D. Hattingh
Annual meeting of the OECD seed certification authorities in Paris	1977-04-25 to 1977-04-29	France	Mr J.F. van Wyk
Annual meeting of the OIE on animal health in Paris	1977-05-23 to 1977-05-28	France	Mr L.J. Grobler
Meeting of the Executive Committee and Congress of the International Citrus Organisation in Orlando, USA	1977-04-29 to 1977-06-02	USA	Dr J.P. van der Merwe
2nd International Citrus Congress in Orlando, USA	1977-04-16 to 1977-06-01	USA	Dr J.H. Grobler
2nd International Citrus Congress in Orlando, USA	1977-04-28 to 1977-06-01	USA	Dr D.L. Milne
2nd International Citrus Congress in Orlando, USA	1977-05-01 to 1977-05-28	USA	Dr G.S. Bredell
2nd International Citrus Congress in Orlando, USA, followed by short study tour	1977-04-26 to 1977-06-10	USA	Dr J.H. de Lange
2nd International Citrus Congress in Orlando, USA, followed by short study tour	1977-04-28 to 1977-05-27	USA	Dr S.F. du Plessis
International Symposium on Controlled Environment Agriculture and 7th International Agricultural Plastics Congress	1977-04-04 to 1977-04-20	USA	Dr J.N. Moll
Meeting of the World Veterinary Association in Paris	1976-05-26 to 1977-06-16	France	Mr A.G. Comrie
Symposium on Resviridae	1977-05-12 to 1977-05-17	USA	Dr B.C. Jansen
Annual congress of the OIE on animal health in Paris	1977-05-21 to 1977-05-25	France	Dr B.J. Erasmus
OIV executive meeting and committee meeting, in capacity of Vice-President	1977-05-09 to 1977-05-14	France	Dr J.P. van der Merwe
Horticultural symposium in Ghent, Belgium		Belgium	Dr J.D. Burger
			Mrs D.D. Nel

Study tours and official visits

Purpose of tour/visit	Date	Place	SA officer
Discussions with seed authorities	April 1976	Bordeaux, The Hague	Mr L.J. Grobler
Study tour in order to acquire information on veterinary diagnostic services	1976-05-13 to 1976-06-20	Britain, Belgium, Israel and USA	Dr P.P. Bosman
Visit to Israel on viticultural co-operation after OIV meeting in Yugoslavia	1976-08-22 to 1976-09-08	Israel	Dr J.D. Burger
Study of liquor control legislation and demarcation of areas	1976-04-19 to 1976-05-14	Germany, Italy, Austria	Mr H.J. du Toit
Study tour to investigate computer centres and the computer system of the Department of Agriculture of the USA	1976-04-01 to 1976-05-01	USA, Canada	Mr C. Kok Mr G.J. Smit
Study of the collection, comparison and exchange of information on grazing and livestock problems	1976-10-12 to 1976-11-11	Australia	Dr E.M. van Tonder
Study of plant protection research in the maize and sorghum industry	1976-08-15 to 1976-09-11	USA	Mr M.C. Walters
Study of the tracing and identification of potato viruses and virus purification of potatoes; gathering of information on seed potato producers and potato breeding programmes	1976-09-18 to 1976-10-09	Holland, England and Scotland	Mr P.J. Prins
Study of chicory production	1976-10-09 to 1976-10-29	England, France, Holland and Austria	Mr J.D. Aucamp
Study of the control of bush encroachment, survey techniques and general veld control measures	1976-10-07 to 1976-10-28	USA	Mr A.J. Aucamp
Investigation into the in-service training of agricultural officers	1976-06-11 to 1976-07-24	Belgium, the Netherlands and West Germany	Mr C.H. de Klerk
Study tour on bush encroachment, survey methods and general veld control measures	1976-10-07 to 1976-10-28	USA	Mr J.P. van Niekerk
Study tour on the cultivation and utilisation of forage crops	1976-05-05 to 1976-06-06	Australia and New Zealand	Dr V.D. Wasserman
Study tour on the in-service training of extension officers and attendance of a course at Ft Collins	1976-06-21 to 1976-08-02	USA	Mr J.H. Iones Dr F.J. Kok
Investigation into fruit breeding; visit to research stations in connection with selections and rootstocks	1976-07-17 to 1976-08-19	England, USA, Canada	Dr N. Hurter
To build up contacts with other researchers and have discussions with persons handling South African fruit	1976-07-01 to 1976-07-20	USA, England	Mr J.C. Combrink
Research and farming practices with regard to subtropical fruit, particularly ginger, kiwi fruits, macadamia and pistachio nuts	1976-04-26 to 1976-05-24	Australia and New Zealand	Mr A.J.J. Joubert
Study tour on soil chemical and clay mineralogical research	1976-06-14 to 1976-07-05	Israel, Belgium, Scotland, the Netherlands, Germany	Dr H.C.H. Hahne
Study tour on timber insects and timber treatment	1976-04-26 to 1976-05-17	Germany, England and the Netherlands	Dr H. Geertsema
Investigation of virus diseases in flowering plants, ornamentals and vegetables	1976-04-20 to 1976-05-13	Holland, Denmark, England, France	Dr P.J. Klesser
Investigation of poultry mycoplasma, serotyping, vaccine preparation and advanced diagnostic techniques	1976-07-30 to 1976-08-28	USA	Dr S.D. Buys
Investigation of perinatal deaths and infertility in cattle and sheep, with special reference to brucellosis and mycoplasmosis	1976-05-14 to 1976-06-09	Israel, Germany, Denmark, Belgium, England	Dr A.P. Schutte
Study tour in connection with: 1. Investigation of registration procedures and requirements for veterinary preparations; 2. Investigation of specific methods of determining the tolerances of livestock remedies; 3. Procedures with regard to the application of the poison group classification for agricultural and livestock remedies	1976-09-24 to 1976-11-03	England, USA, Switzerland and Germany	Dr T.W. Naudé
Study tour on genetic research after attendance at a congress in Dublin	1976-06-18 to 1976-07-17	France, Switzerland, Germany, England and Ireland	Mr E.H.H. Meyer
Study of general viticultural research, cultural practices and winemaking	1976-09-08 to 1976-09-23	USA	Dr J.D. Burger
Collection of information on leaf spot diseases in groundnuts		USA	Prof. G.D.C. Pauer
Study of pig improvement schemes	1976-04-12 to 1976-04-30	Scotland, Ireland, England, Holland, Germany, Denmark	Mr M.C. Henderson
Study tour in connection with agricultural engineering, visits to research stations and building up of contacts with engineers in Israel	1976-06-18 to 1976-07-18	USA, Canada, England, Sweden, Israel	Mr J.J. Bruwer

Purpose of tour/visit	Date	Place	SA officer
Study tour on meat research	1976-08-29 to 1976-09-21	Sweden, the Netherlands, France, England	Dr R.T. Naudé
Visit to Olsa firm in Milan to obtain information on production equipment	1976-09-27 to 1976-09-28	Italy	Dr A. Pini
Study tour on the behaviour of the honey bee	1976-08-28 to 1976-09-17	USA	Dr D.J.C. Fletcher
To study open mining and irrigation problems	1976-08-01 to 1976-08-29	USA, Germany, Israel, England	Dr M.C.F. du Plessis
Visit to the Lisbon Herbarium to gather information for his studies	5 days in July 1976	Portugal	Dr J. Serfontein
Research on jointed cactus	1976-07-13 to 1976-10-22	Argentina, Columbia, Mexico, Trinidad, Barbados, Martinique, Dominica, Guadeloupe, Antigua, St. Kitts, Puerto Rico, Dominican Rep., Jamaica	Dr H. Tölken
Study tour on wool production	1976-08-20 to 1976-09-11	Australia	Mr J.H. Hoffman
Study tour on sheep breeding, following wool congress	1976-08-23 to 1976-09-22	Australia	Mr J.H. Hofmeyr
Training in electron-microscopy	1976-09-13 to 1976-10-08	Israel, England, Germany, France	Mr G.J. Erasmus
Study of the organisation and structure of the departments of agriculture of these countries	1976-10-16 to 1976-11-06	Australia, New Zealand	Mr H.J. van Tonder
Visits to research centres following entomological congress	1976-08-16 to 1976-09-13	USA, Israel	Dr D.W. Immelman
Study tour following conference in Brighton	1976-11-13 to 1976-12-07	England, Germany, Switzerland, Israel	Dr Y. Ben-Dov
Study tour on abattoirs and meat-processing factories with a view to the future construction of such facilities in SA	1977-04-23 to 1977-05-14	England, Holland, Belgium, Germany	Mr I.D. Hattingh
Visits to Washington, Rungismark, IFAC in Montpellier and Corsica	1977-04-29 to 1977-06-02	USA, France, Corsica	Dr J.D. Coetzee
Study tour on nematological research	1977-04-16 to 1977-06-01	USA, United Kingdom	Mr G. Kleinhans
Visits to research centres at Lake Alfred, Riverside, Rothhamstead, Long Ashton, Rungismark, IFAC, Montpellier and Corsica	1977-04-28 to 1977-06-01	USA, United Kingdom, France	Dr J.H. Grobler
Visits to research institutes at Gainesville, Lake Alfred, Tampa and Riverside	1977-05-01 to 1977-05-28	USA	Dr D.L. Milne
Study tour in connection with brucellosis vaccine	1977-05-26 to 1977-06-16	England, France, Germany	Dr G.S. Bredell
To accompany the Minister of Agriculture on a goodwill visit to Iran	1977-04-21 to 1977-04-28	Iran	Dr J.H. de Lange
Study tour on bluetongue and virus diseases	1977-05-17 to 1977-06-06	USA, Canada	Dr B.C. Jansen
To investigate the Burroughs B7800 computer system in order to decide whether to purchase such a system for the Department	1977-05-12 to 1977-05-22	USA	Dr W.A. Verbeek
Study tour and course on distance observation and visit to the USA soil conservation service in connection with data processing	1977-04-29 to 1977-06-03	USA	Dr B.J. Erasmus
			Mr G.J. Smit
			Mr J.F. Eloff

ATTENDANCE AT SYMPOSIA, CONGRESSES AND STUDY TOURS

The following table reflects the number of visits by officers of the Department to African and overseas countries, and the expenditure involved, during the past six financial years:

Financial year	Visits to African states	Visits to overseas countries	Departmental expenditure	Funds made available by boards and other bodies	Total expenditure
			R	R	R
1971/72	51	75	45 100	18 600 (a)	63 700
1972/73	90	53	39 730	15 000 (b)	54 730
1973/74	56	62	60 610	30 380 (c)	90 990
1974/75	40	89	114 200	27 700 (d)	141 900
1975/76	20	91	107 790	40 985 (e)	148 775
1976/77	13	58	91 903	16 131 (f)	108 034

- (a) Expenditure in respect of 19 officers not included, since all costs were borne by the host organisations and no figures are available
- (b) Ditto in respect of 22 officers
- (c) Ditto in respect of 19 officers
- (d) Ditto in respect of 19 officers
- (e) Ditto in respect of 16 officers
- (f) Ditto in respect of 16 officers

SCIENTIFIC AND OTHER VISITORS

Name of visitor	Country and institution	Period of visit	Purpose of visit	Institutions visited
Dr Archibald	Canada	February 1977	To gather information on research work at Onderstepoort	Onderstepoort
Mr Angiboust	France	1977-05-13 to 1977-05-18	To gather information on horticultural crops	Horticulture and OVRI
Dr Ashton	England	August 1976	To gather information on research work at Onderstepoort	Onderstepoort
Dr A.L. Barnett	Australia	1976-05-27 to 1976-05-28	Discussions on virus diseases, including the control of foot-and-mouth disease	Onderstepoort
Mr W. Brune	Brazil	Three months	Research at own expense	Citrus
Mr M.M.H. Bungey	Australia	One day	Interview with Dr W.A. Verbeek	Secretariat
Dr E. Boccedi	Italy	1976-05-19	To gather information on local disease conditions that could affect meat imports	Veterinary Services
Drs Blajan and Le Hasif	France	1976-04-21	Discussions on the possibility of importing bull semen from the Ivory Coast	Veterinary Services
Dr R. Brande	England: Member of a pig development organisation	1976-06-14	To gather information on the South African pork industry	Onderstepoort
Mr B.W. Cull	Australia	1977-06-06 to 1977-06-15	Courtesy visit	Citrus
Mr F. Coolman	The Netherlands	January 1977	To supply information to the division concerned	Engineering
Mr W. Coackley	Australia	1977-01-10 to 1977-01-12	Discussions on methods of diagnosing disease	Onderstepoort
Mr E. Embree	USA	1976-04-16	Sight-seeing tour	Animal and Dairy Science
Mr D. Eckersley	Australia: President of the Australian Farmers' Federation	1976-04-16 to 1976-04-28	Sight-seeing tour	Head Office, Horticulture and Transvaal Region
Dr C.P. Ellis	Oman (Middle East)	1976-12-21 to 1976-12-25	To gather information on rabies control measures	Veterinary Services
Mr Eyre	England: Member of the British Agricultural Export Council	1976-05-25	Discussions on seed exports	Plant and Seed Control
Mr C. Flemming	Tasmania	5 days during July 1976	Sight-seeing tour	Horticulture and Botany
Group of German students	Germany	January 1977	Discussions	Horticulture
Group of French horticulturists	France	November 1976	Sight-seeing tour	Fruit and Citrus
Mr Goldman	Israel	1976-10-10 to 1976-10-15	Interview with Dr J.E. Erasmus	Winter Rainfall Region
Mr L. Gordero	Nicaragua	1976-11-30	Discussions	Eastern Cape Region
Group of Merino wool growers	Australia	1976-05-13 to 1976-05-14	Sight-seeing tour	Eastern Cape Region and Karoo Region
Group of five Australians	Representatives of the Department of Agriculture and Meat of Western Australia	1976-08-04	Study tour on the classification of meat and marketing of cattle	Onderstepoort
Group of three farmers	New Zealand	1976-08-23	Sight-seeing tour	Onderstepoort
Group of 25 farmers	New Zealand	1976-05-28	Sight-seeing tour	Onderstepoort
Mr J.C. Heath	Australia	1976-06-14 to 1976-06-18	Discussions	Crops and Pastures
Group of five farmers	Australia	1976-09-27	Sight-seeing tour	Onderstepoort
Dr E.E. Hartwig	USA	April 1976	To advise on soyabean production in the Republic	Crops and Pastures
Dr F. Hedlund	USA: Director of Fruit and Vegetables	1977-03-30	Discussions on seed production and phytosanitary matters	Plant and Seed Control
Mr J. Hembry	England: Director of Holburn Veterinary Instruments (Pty) Ltd	1976-06-10	Investigation of market opportunities in South Africa	Onderstepoort
Dr Hollings	England	1976-09-22	To gather information on seed	Plant and Seed Control

Name of visitor	Country and institution	Period of visit	Purpose of visit	Institutions visited
Mr T. Huisman	Belgium: Manager of the firm ABBOTT	1977-01-26	Study of the Departmental organisation	Plant and Seed Control
Jakaranda Touring Group	The Netherlands	1976-10-22	Sight-seeing tour	Botany
Mr Lichou	Reunion	December 1976	To gather information on the wine industry and horticulture	OVRI and Horticulture
Mr Fournier	Reunion		To gather information on bean seed production	Plant and Seed Control
Mr Lammers	The Netherlands: Manager of the firm Swaan & Zoon	1976-11-18	Sight-seeing tour	Onderstepoort
Dr S. Lyons	USA	1976	Sight-seeing tour	Onderstepoort
Prof Mahoney and eight students	USA	1976-05-17	To attend a Charolais congress and visit the quarantine station and abattoir	Veterinary Services
Dr E. Mathieu	France: Director of Veterinary Services	1976-04-24 to 1976-05-02	Sight-seeing tour and discussions	Horticulture and Botany
Miss M. McKay	Australia	1976-09-03 to 1976-09-25	Sight-seeing tour	Soutpan and Roodeplaat
Mr and Mrs McQuin	Australia	1976-08-27	Discussions	Horticulture
Miss K. Nott	England	1976-12-24	Discussions	Highveld Region
Mr J.S. Potter	Australia	September 1976	Discussions	Head Office
Dr Powell	USA	May 1976	Visit to quarantine station	Plant and Seed Control
Mr N.G. Santacroce	USA: Inspection Section of the USDA	1977-03-06	Discussions	Veterinary Services
Dr Swanee	England	1976-05-06	Sight-seeing tour	Onderstepoort
Mr Tims	USA	1976-09-16	Sight-seeing tour	Horticulture
Dr E.D. Shaw	Sweden	November 1976	Discussions	Plant and Seed Control
Swedish touring group (vegetable growers)	Sweden		Sight-seeing tour	Plant and Seed Control
Mr J. Schuber	Switzerland	1976-09-22	Sight-seeing tour	Horticulture
Mr Saul	Rhodesia	1976-07-20	Sight-seeing tour	Onderstepoort, OVRI and Natal Region
Mr M. Stoppans	Italy	1976-11-15	Discussions	Head Office and Animal and Dairy Science
Mr P. Stonard	Australia	June 1977	Sight-seeing tour	Plant and Seed Control
Dr H. Theiss	Germany	1976-08-28	Discussions on legislation on plant breeders' rights	Plant and Seed Control
Taiwan's Vice-Premier	Taiwan	1976-10-08	To gather information on seed	Plant and Seed Control
Mr Thomas	USA	1977-03-10	Sight-seeing tour	Horticulture, Citrus, Fruit and OVRI
Mr T. von Flemming	Germany	1976-09-22	Discussions on importing citrus products	Citrus
Mr W.F. Walker	Australia (Tasmania): President of the International Society for Horticultural Science	1976-04-12 to 1976-04-14 and 1976-04-28 to 1976-04-29	Discussions	Plant and Seed Control
Dr F. Liguori	Italy	1977-06-07	Discussions	Plant and Seed Control
Prof G. Stupazzoni	Italy			
Mr K. Yoshioka	Japan	1977-04-25		

REPRESENTATION ABROAD

The following table gives statistical particulars of the activities of the various overseas representatives of the Department during the year under review.

Nature of activities	Europe	Washington	Canberra
1. Visits to research institutes, farms, experimental farms, etc.	312	39	34
2. Conferences and meetings attended	134	18	16
3. Special investigations reported on	10	103	2
4. Reports and publications supplied to the Department and other organisations in the RSA	10 848	6 519	403
5. Number of visitors from South Africa	192	21	8
a. for whom itineraries and principal arrangements were made	170	11	10
b. to whom other assistance was given	482	6	30
6. Interviews granted to non-South Africans	4	15	-
7. Bursary and other South African students assisted			

Nature of activities	Europe	Washington	Canberra
8. Material sent to South Africa			
a. Plant material (number of cultivars and/or separate seed samples)	278	3 141	60
b. Animal material	133	1	-
9. Newsletters compiled and sent to Department	39	32	11

(4) FINANCES

(a) EXPENDITURE (REPUBLIC) 1976/77

	Vote R	Expenditure R
Administration	10 621 000	10 436 002,49
Plant Production Promotion	9 440 000	9 165 119,14
Animal Production Promotion	16 214 000	17 470 057,49
Agricultural Resource Utilisation	15 698 000	12 094 005,41
Entrepreneur Development	5 414 000	5 430 359,89
Supporting and Associated Services	5 063 000	5 062 183,85
	62 450 000	59 657 728,27
Less: Internal Charges	798 000	441 304,59
Total	61 652 000	59 216 423,68

(b) REVENUE (REPUBLIC) 1976/77

	R
Vaccine Sales	1 767 596,00
Product Sales	1 205 798,70
Lease of State Property	170 207,06
Miscellaneous Revenue	1 932 834,00
Total	5 076 435,76
Interest on Tobacco Research Account	14 502,78
Interest on Wine Research Account	2 173,33
Interest on Agricultural Research Account	6 995,74
Total	5 100 107,61

(c) EXPENDITURE (SWA) 1976/77

	Vote R	Expenditure R
Administration	235 000	247 136,61
Plant Production Promotion	326 000	83 888,25
Animal Production Promotion	2 490 000	2 584 017,42
Agricultural Resource Utilisation	3 367 000	2 698 755,34
Entrepreneur Development	492 000	436 769,81
Supporting and Associated Services	60 000	33 512,38
	6 970 000	6 084 079,81
Less: Internal Charges	10 000	-
	6 960 000	6 084 079,81

(d) REVENUE (SWA) 1976/77

	R
Vaccine Sales	13 789,00
Product Sales	313 061,20
Lease of State Property	9 599,15
Miscellaneous Revenue	63 835,00
Total	400 284,35

(5) BUILDINGS

(a) Major works completed		R
Ermelo	Nooitgedacht Research Station: Research Building	344 700
Carnarvon	Carnarvon Research Station: Office and Laboratory Building	82 600
Onderstepoort	Veterinary Research Institute: Isolation Stables for Virus Section	270 500
Verwoerdburg	Irene: Animal and Dairy Science Research Institute: Laying-houses	117 700
(b) Major works under construction		
Stellenbosch	Elsenburg College of Agriculture: Additions to Wine Cellar	103 918
Bloemfontein	Glen College of Agriculture: Research Building	686 100
Bloemfontein	Glen College of Agriculture: Additional Training and Hostel facilities	492 000
Pietermaritzburg	Allerton: Regional Veterinary Laboratory	361 700
Potchefstroom	Potchefstroom College of Agriculture: Office for State Veterinarian	379 700
Pretoria	Soil and Irrigation Research Institute: Additions	1 049 100
Stellenbosch	Plant Protection Research Institute: Quarantine Station: Additional offices and laboratories	389 000
Witriver	Burgershall Research Station: Citrus and Subtropical Fruit Research Station: Offices and laboratories	246 200
Onderstepoort	Veterinary Research Institute: Extensions to library	59 000
Onderstepoort	Veterinary Research Institute: Building for Foot and Mouth Disease Research	3 060 600
Onderstepoort	Veterinary Research Institute: Workshop	272 000

(6) SCIENTIFIC PAPERS PUBLISHED BY OFFICERS OF THE DEPARTMENT: JULY 1976 TO JUNE 1977

Agricultural Chemistry

- BEYERS, C.P. DE L., 1977. Spoorelementtekorte in die Winterreënstreek. *Elsenburg J.* 1(2), 18-19.
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(7) LEAFLET SERIES

FIELD CROPS

Cotton

A.1 Historical review of the cotton industry/ *Geskiedkundige oorsig van die katoenbedryf* - Van Heerden, H.G. & Clarke, P.F.

A.2 *Samestelling en gebruike van katoen* - Bakkes, P.J. & Clarke, P.F.

A.3 *Omvang van katoenverbouing* - Van der Merwe, J.J. & Clarke, P.F.

A.4 Requirements of the South African cotton textile industry/ *Behoeftes van die Suid-Afrikaanse katoentekstielbedryf* - Van der Merwe, J.J.

B.1 *Morfologie en fisiologie van die katoenplant* - Van Heerden, H.G.

C.1 Environmental requirements of the cotton plant - Theron, C.G.

C.2 Cotton-producing areas and trends in cotton cultivation/ *Bestaande produksiegebiede en tendense in katoenverbouing* - Van Heerden, H.G.

C.3 *Gebiede waar katoen verbou kan word* - Ehlers, J.H. & Van Heerden, H.G.

D.1 *Cultivaraanbevelings by katoenverbouing* - Theron, C.G.

D.2 Description of cotton cultivars and their adaptation - Theron, C.G.

E.1.1 Seedbed preparation for cotton/ *Saadbedvoorbereiding* - De Kock, J.

E.1.2 Planting time/ *Planttyd* - De Kock, J.

E.1.3 Plant density and espacement in cotton growing/ *Plantdigtheid en -spasiëring* - De Kock, J.

E.1.4 Planting method for irrigated cotton/ *Plantmetode* - De Kock, J.

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E.2.1 Seedbed preparation for dryland cotton/ *Saadbedvoorbereiding* - Dippenaar, M.C.

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- H.22 Australian bug on citrus *Icerya purchasi* Maskell - Cilliers, Catharina J.
- H.26.1 An integrated approach to the control of resistant red scale, based on experiments at Letaba estates/*Die oorskakeling na geïntegreerde beheer van weerstandbiedende rooidopluis volgens proewe op die Letaba-landgoed* - Bedford, E.C.G. & Du Toit, W.J.

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- J.3 Norms for interfarm comparisons by wine-grape producers in the Western Cape/*Norme vir tussenplaasvergelings deur wyndruifprodusente in Wes-Kaapland* - De K. Marais, A.

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B.3 Beef cattle: Performance and progeny-testing scheme - Bosman, D.J.
B.4 Beef cattle: The selection of breeding bulls - Bosman, D.J.
B.5 Beef cattle: Selection criteria - Bosman, D.J.
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C.1.2.1 *Weiveldbeheerbeginsels: Sentrale grasveldstreek* - Skinner, T.E.
C.1.2.3.3 The importance of rotational rest periods, degree and frequency of utilisation - Edwards, P.J.
C.1.2.5.2 *Die voedingswaarde van veld* - Engels, E.A.N.
C.1.2.6.1 The physical planning of the veld for beef farming - Venter, A.D. & Drewes, R.H.
D.1.3 Feeding according to the different grazing areas: High potential areas/ *Voeding volgens die verskillende weiveldgebiede: Hoëpotensiaalgebiede* - Lesch, S.F.
D.4.1 *Intensiewe vleisbeesvoeding - beginsels en toepassing* - Meissner, H.H.
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D.4.2.2 *Voer en afronding van osse op droë ru-voere* - Oosthuizen, S.A.
D.4.3 Choosing a feeding system for the weaner' steer or heifer in an intensive beef

enterprise/*Voerstelsel vir die speentollie en -vers in 'n intensiewe vleisbeesonderneming* - Meissner, H.H.

D.4.5 *Die keuse van geskikte beeste vir intensiewe voeding* - Meissner, H.H.

D.8 *Teelpraktyke vir die hoëpotensiaalgebiede* - Navorsingstasie, Nooitgedacht

E.3 Veterinary aspects of beef production in feedlots - Du Casse, F.B.W.

E.4 Gallsickness/*Galsiekte* - Barrowman, P.R.

G.1 Beef-carcase grading - Naudé, R.T.

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No. 141 Principles of economic dairy-cattle feeding/*Beginnels van ekonomiese melkbeesvoeding* - Liebenberg, L.H.P.

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A.2 The future of the wool industry/*Die toekoms van die wolbedryf* - Joubert, Sen. G.J.

A.3 Sheep farming within the framework of optimal resource utilization/*Die beoefening van skaapboerdery binne die patroon van optimale hulpbronbenutting* - Jansen, Dr B.C.

A.4 The utilization of agricultural resources for wool production/*Die benutting van landbouhulpbronne vir wolproduksie* - Verbeek, Dr W.A.

A.5 The economics of woolled sheep farming/*Ekonomiese aspekte van wolskaapboerdery* - Siertsema, J.K.

A.6 *Die uitdaging waarmee die wolboer te kampe het* - Dolling, C.H.S.

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D.9 Lambing: Efficient management and reduction of lamb mortality - Pagel, R.F.E. & Du Plessis, I.J.H.

E.3.1 External parasites: Introduction/*Uitwendige parasiete: Inleiding* - Howell, C.J.

E.3.2 External parasites: Insects/*Uitwendige parasiete: Insekte* - Howell, C.J.

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E.3.4 External parasites: Mites/*Uitwendige parasiete: Myte* - Howell, C.J.

E.6.3 Diseases caused by organic poisons: fungi, algae and plants/*Siektes veroorsaak deur organiese gifstowwe: giftige swamme en alge* - Bath, G.F.

E.10 Sheep diseases caused by rickettsial and chlamydial organisms - Van Tonder, E.M.

F.1 Shearing shed and facilities - Schuurman, P.

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F.1 Economics of pig production - Ortman, G.F.

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B.2 *Behuising van pluimvee - algemene beginsels* - Joubert, J.J.

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E.1 Poultry: General feeding principles - Erasmus, J.

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